The Electrical Industry's Weekly Magazine

April 29, 1957

Electrical World

Price 50 Cents

A McGraw-Hill Publication

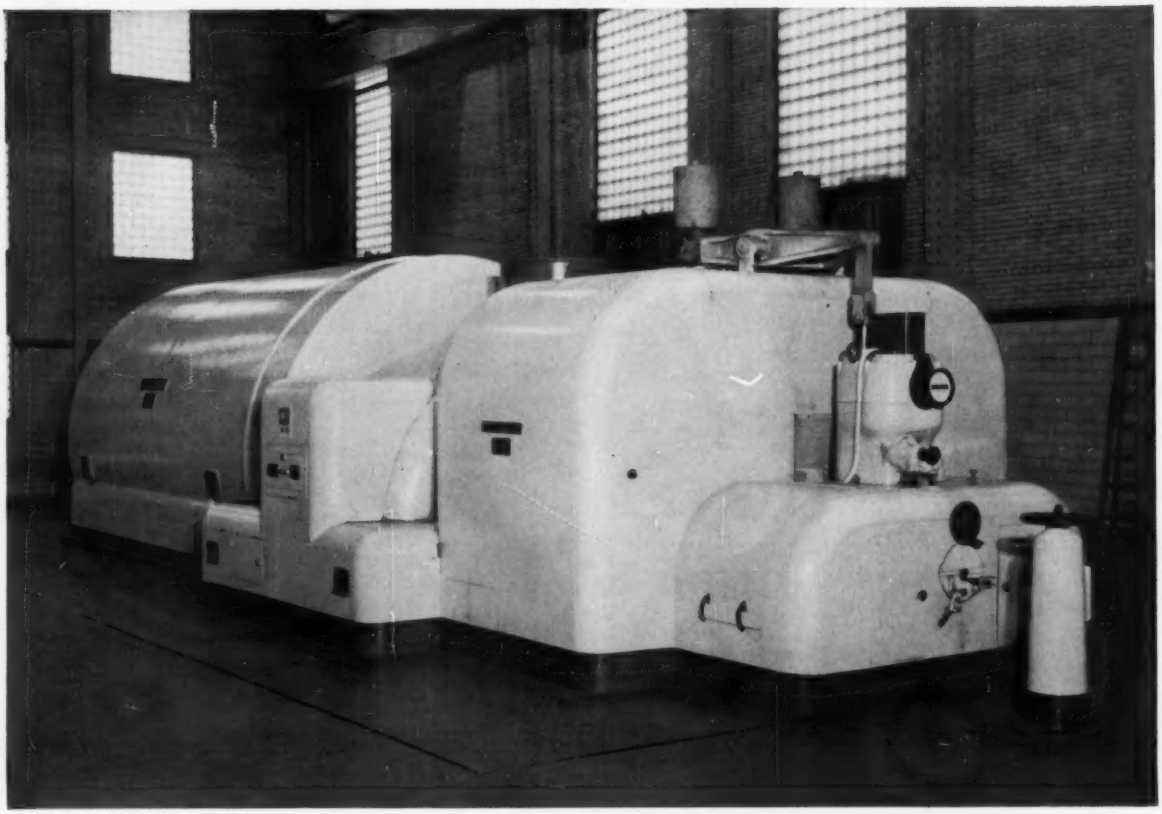
Distribution for Tomorrow's Industry . . . Page 101

Outlook for Business: High Spending for 4 Years . . . Page 89

E B POWER GS W 12-
UNIVERSITY MICROFILMS INC
313 N 1 ST
ANN ARBOR MICH * C

"There was no rust or sludge . . ."

• *In this plant (name on request) a Westinghouse 30,000 kw. generator was disassembled for a regular check-up. The superintendent reported on the performance of Texaco Regal Oil R&O—*



"We are extremely well pleased with the condition of this unit . . . *There was no rust or sludge . . . wear on the bearings was negligible.* All bearings will be put back into the unit just as they were removed. *Texaco Regal Oil R&O* has done a wonderful job..."

You'll get similar reports from operators everywhere who are using *Texaco Regal Oil R&O*. This is the famous oil that's refined to premium quality then further improved with special additives to prevent rust, sludge and foam. *Texaco Regal Oil R&O* has an extra long service life — gives you an extra margin of safety in the operation of your turbines.

There is a complete line of *Texaco Regal Oils R&O* to meet the requirements of all leading turbine builders. A Texaco Lubrication Engineer will gladly help you select the proper one. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils R&O

FOR ALL TURBINES

TUNE IN . . . METROPOLITAN OPERA RADIO BROADCASTS EVERY SATURDAY AFTERNOON

Electrical World

Vol. 147, No. 17 APRIL 29, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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Cannon Blasts AEC Atom Policy

Calls federal program to aid private construction of nuclear plants illegal; urges "subsidies" ban.....p 86

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Survey shows optimistic plan for next 4 years; all business to spend 12% more in 1957.....p 89

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Metal-clad units at new outdoor site solve space problem, cut construction outlay, outage time on 13.8-kv facilities..p 98

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Soil Borings Improve Line Design

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Distribution for Tomorrow's Industry

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this feature of CM-OT provides light weight and unusually high compressive strength

It's the corrugated bronze tape that makes CM-OT particularly suitable for direct burial power and control circuits. It provides a cable that is light weight, has high compressive strength, and whose cost approximates standard rubber-insulated, neoprene-sheathed cables. In addition, the bronze tape serves as an excellent shield and ground for control cable circuits in those utility and industrial applications where these are considered desirable.

The CM-OT sheath consists of a 5-mil, helically-wrapped, corrugated bronze tape . . . a wall of Okoprene reinforced with an Okoprene-filled cable tape . . . and an outer wax and mica lubricated finish. While primarily designed for multi-conductor signal and control cables, the CM-OT sheath can be supplied over single and multi-conductor power cables with conductor sizes as large as #4/0 Awg.

Here are just some of the basic direct burial installation requirements that CM-OT meets: resistant to earth pressures, water, corrosion, electrolysis, fungi, insects and small rodents, lightning surges and extremes of temperature. It is flexible and easy to handle, splice and terminate with conventional tools . . . can be installed in long lengths (1500-2500 feet or longer) . . . adaptable for aerial, underground duct, rack or conduit installations . . . long life and reliability.

For more complete details, write for Bulletin EW-1086 to The Okonite Company, Passaic, N. J.

where there's electrical power . . . there's **OKONITE CABLE**

4741

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. . . *from the publisher*

When Industrial Editor Ken McLean first started research for his special report, "Distribution for Tomorrow's Industry" (page 101), he had little idea of how really significant his assignment would turn out to be.

"Talk about low Housepower in homes," he said later, "we have the same problems in industrial plants. Only we're not talking about three or four thousand kilowatthours a year. We're talking about big stuff—100,000 kilowatthours and more."

Happily though, the industrial electrical engineer, unlike the homeowner, already recognizes his plight. He knows that increased production means more machinery. More machinery means more power. And more power means need for bigger and better systems to distribute it. His problem is how to develop a system most economically and at the same time make it flexible enough for still further growth.

That's the purpose of McLean's weeks of digging. Whichever side of the industrial plant substation you're on—the one that buys and distributes power or the one that sells it—you'll find the report a highly profitable investment of your reading time.

Fischer Black

ELECTRICAL WORLD

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An example of Allis-Chalmers leadership

They Whisper While They Work!

These two 100,000-kva Allis-Chalmers transformers are good neighbors... thanks to careful pre-planning.

Installed in the middle of a residential area, these two large transformers could have created a public relations headache.

They didn't . . . because of elaborate planning by the utility's engineers working together with A-C.

In fact, this installation is a model of what can be done.

Before any designing was started, Allis-Chalmers mobile sound laboratory equipment was brought in. Day and nighttime studies of ambient characteristics indicated that the most economical solution to the problem required a twofold attack.

1. Design and build a low noise level transformer unit with frequencies melded to the ambient.

2. Build a masonry barrier around the transformers to reduce the noise level further.

So critical were the conditions that neither step by itself would do the job.

Today, the transformers are in full operation . . . and there are no complaints from the neighbors.

Transformers like this are an outgrowth of continued research by Allis-Chalmers into magnetostriction and resonance in A-C sound laboratories, acoustical proving ground and mobile research unit.

* * *

For help in finding the best and most economical means for solving sound problems, contact your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

This was the area with residences as close as 170 feet from the proposed transformer locations.

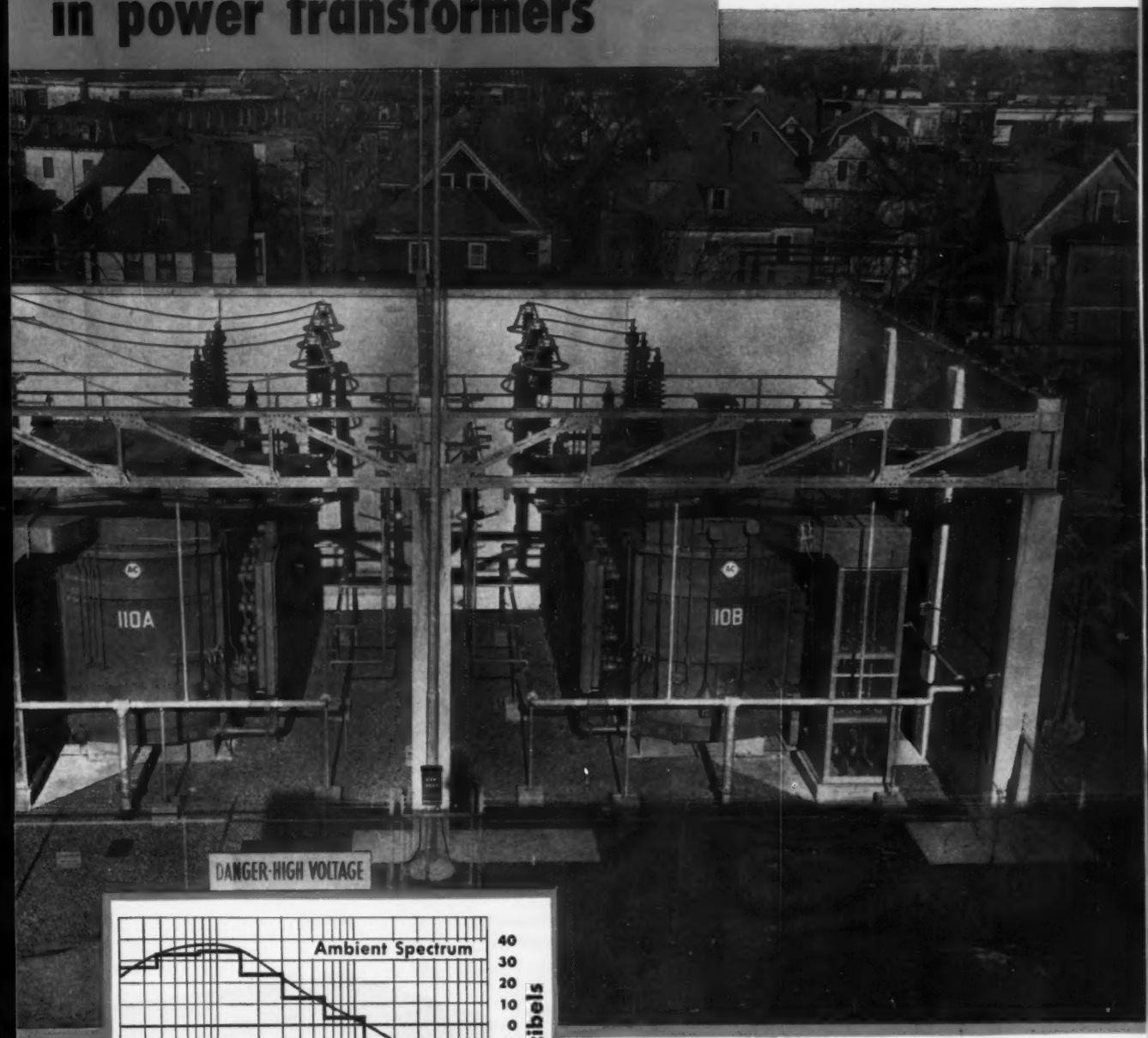
Mobile sound testing equipment was brought in to study ambient characteristics and find a noise level that would not be objectionable.

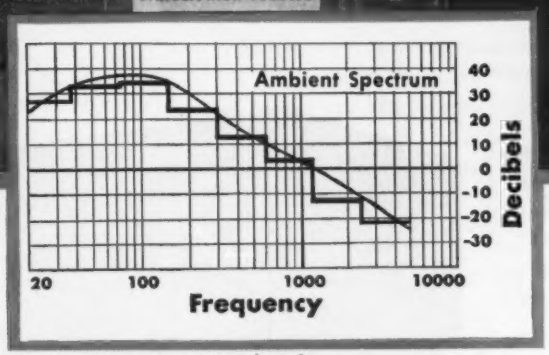
A-C ALLIS-CHALMERS

A-5353

ALLIS-

in power transformers

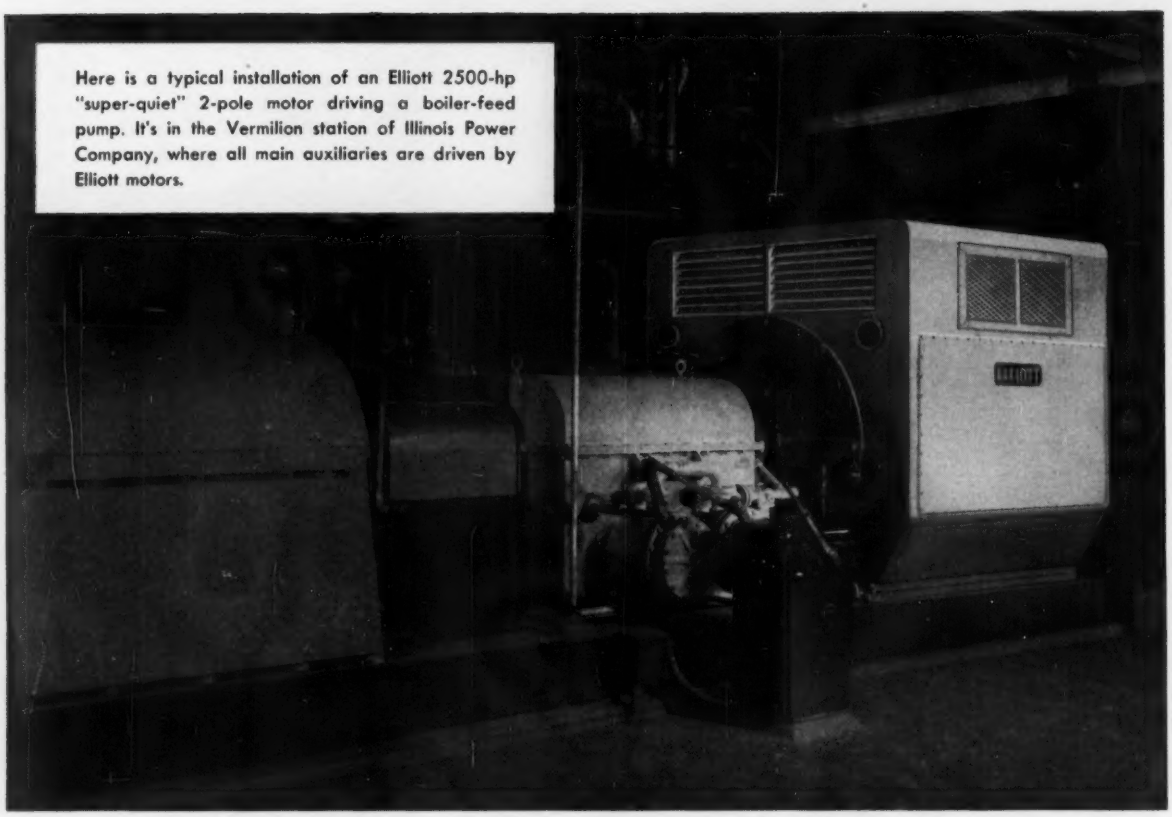




On-the-site testing in quiet predawn hours determined minimum masking noises.

Transformer noise level lower than standard and use of masonry barriers were dictated by the severe requirements of the neighborhood.

CHALMERS



Here is a typical installation of an Elliott 2500-hp "super-quiet" 2-pole motor driving a boiler-feed pump. It's in the Vermilion station of Illinois Power Company, where all main auxiliaries are driven by Elliott motors.

When an ELLIOTT *"super-quiet" 2-pole motor goes in* nerve-wracking noise goes out!

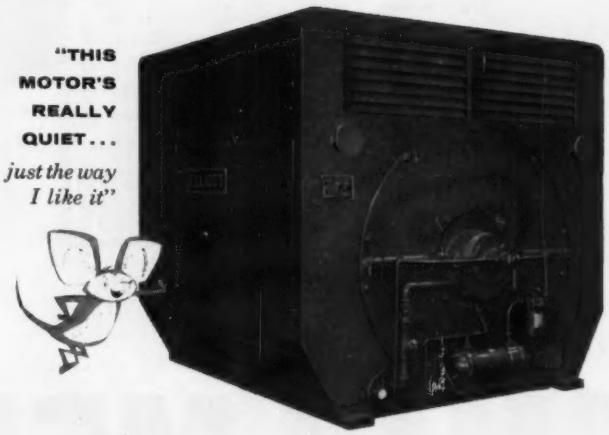
"So much noise in here I can't even think."

That was the usual comment whenever a large 2-pole motor was operating. Besides reducing employee efficiency, it caused irritations both inside and outside of the plant. To eliminate these difficulties, Elliott engineers spent many years developing a "super-quiet" motor. Now when an Elliott 2-pole induction motor is installed they say, "That's the quietest large 2-pole motor I've ever heard! What a whale of a difference!"

And they're right. There is a BIG difference—for when noise-making motors go out, operator comfort and efficiency goes up. Community relations are improved.

All this was made possible by redesigning certain elements of the rotor, stator and ventilating system. The revolutionary results have brought a steady stream of orders for "super-quiet" motors. Further details, or a demonstration of the new Elliott motor can be arranged. Call your Elliott district office or write . . .

"THIS MOTOR'S REALLY QUIET... *just the way I like it"*



ELLIOTT Company

Ridgway Division • Ridgway, Pennsylvania

R7-2

Steam Turbines • Motors • Generators • Deaerating Heaters • Ejectors • Condensers • Centrifugal Compressors • Turbochargers • Tube Cleaners • Strainers

Wire sculpture by Henry Szafarz

The Inside Story

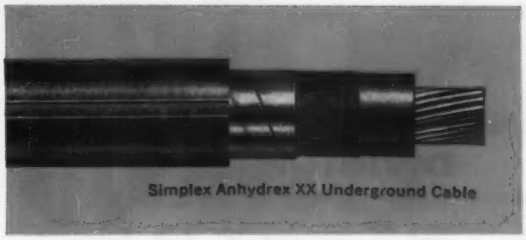
Beneath the surface, there's a lot going on.

An underground river of power surges through innumerable cables, supplying the electrical energy that keeps the entire community rolling smoothly.

Throughout the nation, Simplex products are used extensively in such applications. This is particularly true of ANHYDREX XX, the ideal all-purpose cable for high-voltage use. This expertly engineered cable is popularly employed in the 2001 to 35,000 volt range, and has a Conductor Temperature Rating of 90°C up to 5 KV (a rating never attained before the development of ANHYDREX XX).

For more technical data, write for Booklet 1023.

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.

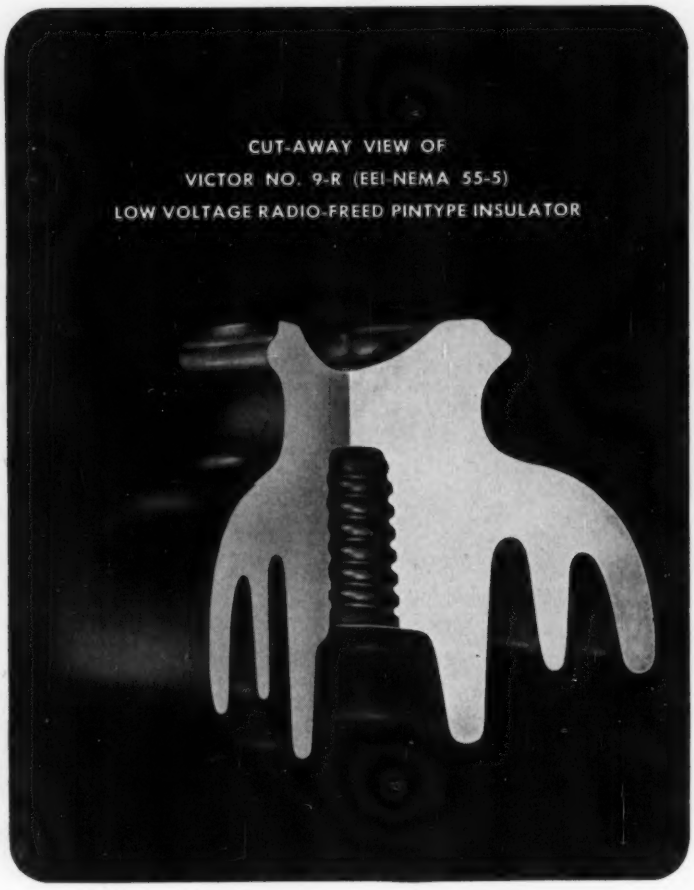


Simplex Anhydrex XX Underground Cable

Simplex

LIVE BETTER ELECTRICALLY

CUT-AWAY VIEW OF
VICTOR NO. 9-R (EEI-NEMA 55-5)
LOW VOLTAGE RADIO-FREED PINTYPE INSULATOR



NO INSULATOR IS MADE WITH GREATER CARE THAN A *VICTOR* PINTYPE!

VICTOR Pintypes are designed and manufactured with the same *Purified* Porcelain as high voltage units. VICTOR Pintypes are design-tested with steep front impulse wave in addition to the normal 1.5 x 40 standard impulse wave.

The conductive glaze on VICTOR radio-freed units is readily *distinguishable* and *permanent*. Accurate, die-formed porcelain threads assure ease of installation. Machine glazing guarantees uniform glaze application, giving optimum dielectric and mechanical strength. *Every* VICTOR Pintype receives the same careful routine electrical testing as VICTOR high voltage insulators. That's why—when you buy VICTOR, you just can't buy better pintypes.

New . . .

VICTOR CATALOG

Now ready for distribution is Victor's newest and most extensive catalog. One of the most complete in the field, it includes illustrations and data on many items being produced at VICTOR and not previously shown, up-to-date EEI-NEMA Standards, and an outline of VICTOR'S new plant, research, testing and manufacturing facilities. It's FREE! Write for your copy.

Nothing beats Porcelain

FOR ELECTRICAL INSULATORS!

VICTOR INSULATORS DIVISION

I-T-E CIRCUIT BREAKER CO., Inc.

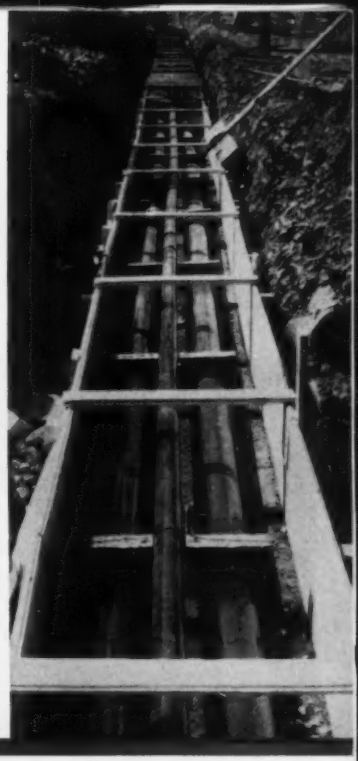
VICTOR, N.Y.

Butyrate conduit means direction changes without fittings

The semi-rigid nature of Tenite Butyrate allows the engineer maximum flexibility in planning and revising—since many direction changes can be made without costly and job-prolonging fittings.

Butyrate conduit means resistance to corrosion

Conduit of Tenite Butyrate is unaffected by corrosive and electrolytic action of soil. This is your assurance of many years of trouble-free service.



What can conduit of Tenite Butyrate plastic mean to you?

Conduit made of Tenite Butyrate plastic means many things to many utilities—for use in carrying both electric power and telephone cables.

To Long Island Lighting Company, Hicksville, N.Y., for example, Butyrate conduit meant resilience—which enabled it to meet conditions encountered in filled-in marsh areas. Conduit of Tenite Butyrate "gives" with ground movement instead of parting or fracturing.

To other companies it may mean: freedom from corrosion, high impact strength, non-inductance, ease in cutting and joining, extra-smooth walls, or semi-rigidity.

All of these benefits of Tenite Butyrate plastic are available to you—plus the economies in installation and maintenance which accompany them.

Discover how you can share in these benefits. For complete information and a list of suppliers in your area, mail the coupon below.

1932—EASTMAN'S 25TH YEAR IN PLASTICS—1957

Butyrate conduit means lightness in weight

Conduit of Tenite Butyrate is extremely easy to handle, thanks to its light weight. A 20' length of 4" conduit can literally be carried "with one hand behind your back."

TENITE
BUTYRATE
an Eastman plastic

EASTMAN CHEMICAL PRODUCTS, INC.
subsidiary of Eastman Kodak Company, Kingsport, Tennessee

Please send me information on cable conduit made of Tenite Butyrate and a list of companies manufacturing Butyrate conduit and fittings.

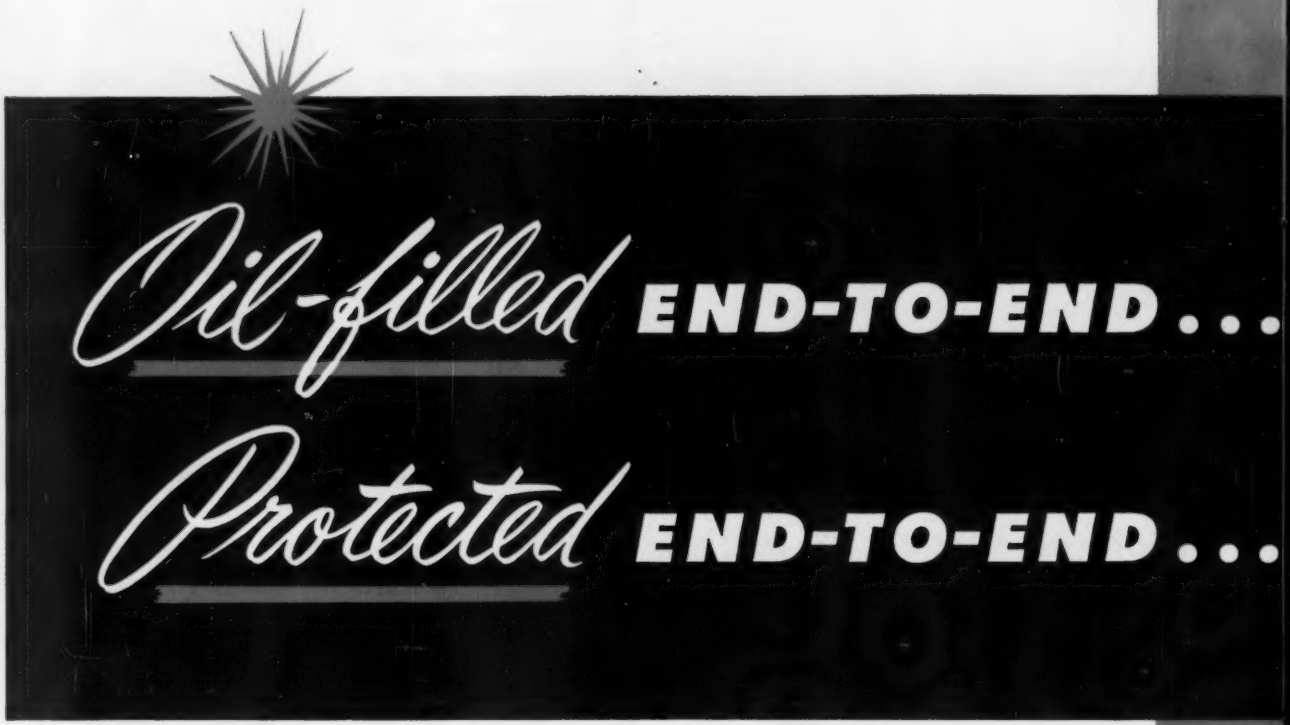
NAME_____

POSITION_____

COMPANY_____

STREET_____

CITY_____ ZONE_____ STATE_____



CONDENSER-TYPE • To save equipment size and weight . . . to facilitate interchangeability for replacement in older equipment . . . ASA Standards call for bushings of small diameter. This requirement is met, with wide safety factors in operation, by Lapp POC* Bushings. The internal voltage stresses resulting from these small diameters are distributed by a series of equal-capacitance condensers equally sharing total bushing voltage.

PAPER-OIL INSULATION • For its high dielectric strength, low dielectric loss and proved dependability in service, Kraft paper oil-impregnated is preferred as insulation for highest-voltage applications. That's why paper-oil is used in your highest-voltage cables, potheads and bushings—**and** why the condenser core of the Lapp POC* Bushing is paper-oil insulated.

ENCLOSED CORE • The housing which encloses the condenser core of the Lapp POC* Bushing is an assembly of metal and porcelain, permanently sealed against temperature change, cantilever or impact stresses. Leakage currents—which can and do result from moisture and contamination in transformer and circuit breaker oil—can flow only over the porcelain shank of the POC* Bushing. This is positive protection to the bushing core, since there's no charring, tracking or deterioration of porcelain from such leakage current. Storage problems of spare bushings are simplified, too, because the porcelain shank of the POC* Bushing needs no protection from natural elements.

Lapp POC* is the bushing design of the future. It's proved and ready to serve you reliably today.

WRITE for specification data. Lapp Insulator Co., Inc., Le Roy, New York.

Lapp

POC* BUSHING

*PAPER-OIL CONDENSER TYPE
TOTALLY-ENCLOSED CORE
ASA STANDARD

YOU SAVE

45%

with General Electric's NEW

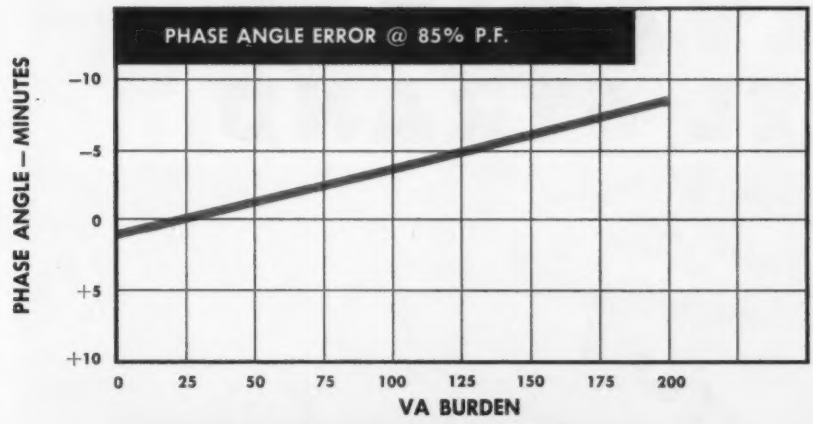
Now you can afford complete 4-wire protection and metering to replace any 3-wire schemes you may now have on your system. This is possible because General Electric's new Cascade potential transformers are priced 45% lower than conventional high-voltage transformers of the same ratings—3 115-kv Cascade units cost almost $4000 less than 2 conventional delta connected types.

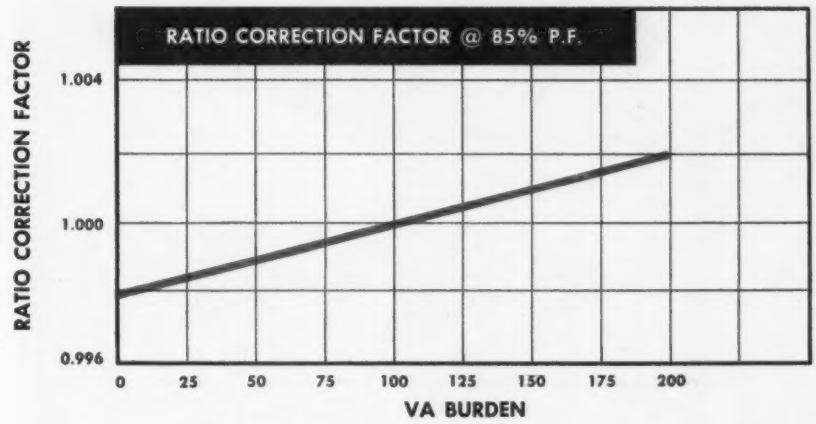
HIGH ACCURACY—Surpassing all ASA accuracy requirements, these new low-cost transformers also overcome the disadvantages of inflexible potential devices such as small useful burden, poor accuracy, and operational variations in characteristics.

LESS SPACE—Besides being 45% lower in cost, the new General Electric Cascade transformers are smaller and lighter in weight. For example, the 115-kv unit has a base only 21 inches square; it is 88 inches high and weighs just 1500 pounds. You save valuable floor space, shipping costs, and more than $2000 in original cost compared to the conventional high-voltage potential transformer.

WHY THESE SAVINGS?—These savings result from General Electric's new cascade design. In conventional potential transformers, as voltage rating is increased, insulation and most other materials have to be increased by about the square of the voltage. In cascade design, voltage is divided and insulation requirements are reduced.

MULTIPLE STAGE DESIGN—General Electric's new Cascade instrument transformer consists of several units connected in series or cascade. For example, in the





Cascade Instrument Transformer

115-kv unit, three stages are employed, each designed for ⅓ the total system voltage. Since only ⅓ the voltage is applied to each section, insulation material requirements are reduced considerably making it possible to get a high-quality instrument transformer selling for approximately $2450.

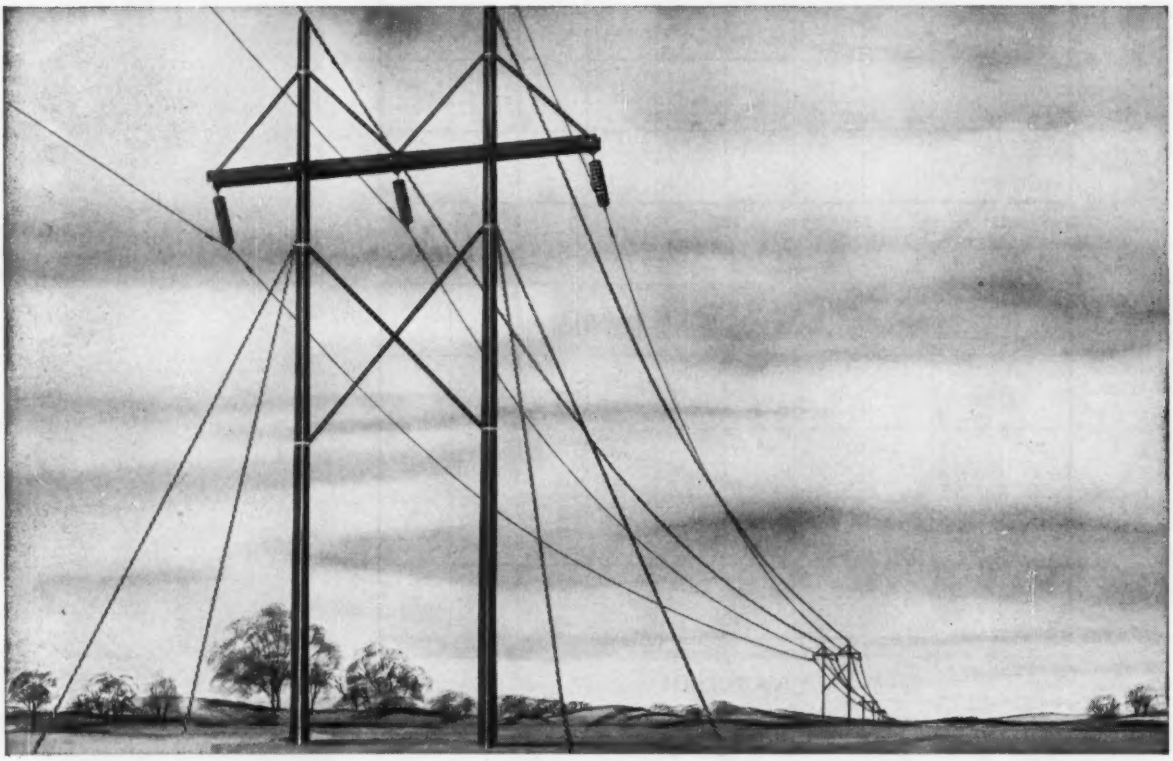
MORE INFORMATION—For more detailed information on General Electric's new Cascade instrument transformers for applications 115 through 230 kv, call your General Electric Apparatus Sales Office. Or write Section 581-4, General Electric Company, Schenectady 5, N. Y.

ESTIMATED NET PRICE COMPARISON

INSULATION CLASS	BIL KV	CONVENTIONAL TYPE ES	CASCADE TYPE EU
115 KV	550	$4,480	$2,450
138 KV	650	5,880	3,220
161 KV	750	7,364	4,060
196 KV	900	14,000	7,700
230 KV	1050	21,000	11,550

GENERAL ELECTRIC

GALVANIZED STEEL STRAND



made in the east and the west for prompt delivery

East or West, there's a single, convenient source of top-quality galvanized strand for ground, messenger and guy wire. That's because dependable time-proved CF&I Galvanized Strand* is produced at both Buffalo, N. Y., and Pueblo, Colorado.

This combination of plant sites enables CF&I to quickly and efficiently fill your strand requirements.

What's more, you're always sure of the quality of CF&I Galvanized Strand. Every phase of its production is handled by the makers of world-renowned Wickwire Wire Rope and Wire Rope Slings...every phase of its production is under CF&I's rigid quality control system.

Next time you need strand—whether it's to ASTM Specification A-122, A-363 or your specification—it'll pay you to contact the closest CF&I sales office listed below.

*three- and seven-wire constructions

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GALVANIZED STEEL STRAND
THE COLORADO FUEL AND IRON CORPORATION

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4247

Shown here, inspecting Kansas City Power & Light's new Mobile units are, left to right: I. C. McLain, RT&E representative; R. L. Wright, E. D. Church and F. D. Cochran of Kansas City Power & Light.

KANSAS CITY POWER & LIGHT MAINTAINS SERVICE WITH RT&E EQUIPPED MOBILE UNITS

When necessary repairs must be made to Kansas City Power & Light's line installations, there's no shut-down on power to customers. Mobile substations like these are wheeled into action, taking over the transformer job while replacement or repairs are made on line units. Service is maintained without interruption.

The heart of these mobile substations depends on versatile RT&E DUAL VOLTAGE TRANSFORMERS . . . rated at 100KVA, 2400x7620 — 120/240/277 volts with *Externally Operated Taps* at 8000/7810/7430/7200 volts. These special units also incorporate RT&E's *Externally Operated primary voltage change-over switch.*

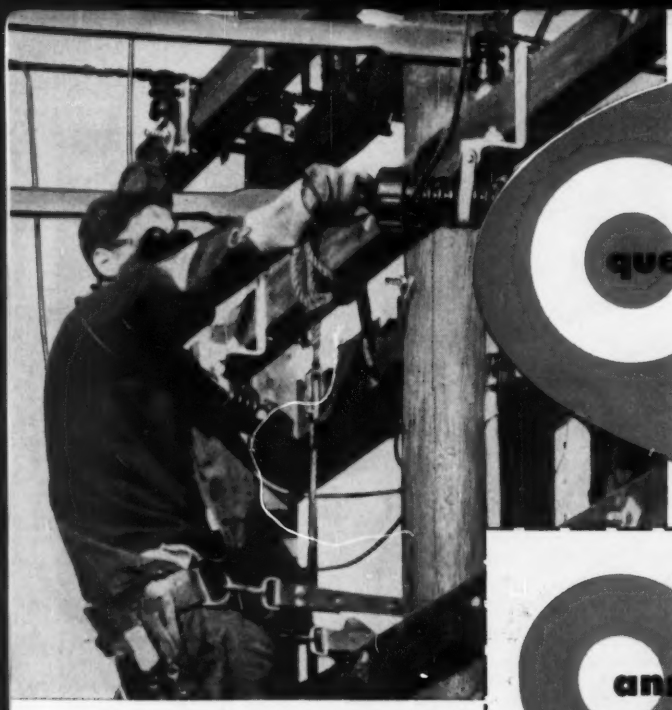
This is just another example of RT&E transformers at work, proving again their merits with many of the industry's outstanding and exclusive features.

EXCLUSIVE WOUND CORE
"WEATHER PROTECTED" DESIGN
EXTERNALLY OPERATED CHANGE-OVER SWITCH
EXTERNALLY OPERATED TAPS
FIVE YEAR GUARANTEE

Ask your RT&E representative to demonstrate the five sound reasons why RT&E transformers are better. Or write RT&E Corporation, Waukesha, Wisconsin.

RT&E CORPORATION WAUKESHA, WISCONSIN

HELPING PROVIDE POWER FOR AMERICA



question: why should this man wear safety glasses while using a Positect?

answer: the safety practices of this utility require safety glasses for all cutouts, even the Positect!

100-ampere Positect

The fused 100-ampere Positect can interrupt as much as 16,000 amperes, asym, and can switch any load it may be carrying—as much as 200 amperes with a 100-ampere link. Using a disconnect tube instead of a fuse tube converts the Positect into an enclosed load interrupter rated 300 amperes, both continuous and switching.

This utility knows that the lineman might close on a fault—and it uses safety glasses to protect him against such an eventuality. It uses the Positect because:

1. it is the only cutout which can be closed on a fault;
2. it directs the blast away from the operator—he is out of reach of the arc, flame, and shrapnel;
3. it minimizes the blast—by an exclusive feature which shortens the arc length;
4. the high inertia characteristic of its bayonet action opposes the recoil forces.

The long and short of it is this: it takes sound operating practices *and* good equipment to safeguard your linemen.

LIVE BETTER ELECTRICALLY

Specialists in High-Voltage Circuit Interruption Since 1910

S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS • U. S. A.

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POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

S&C

NEWS-SCOPE

FUTURE NEWS ▶ **We're standing by our forecast of an 8.2% rise in output this year.** Despite the relatively slow start during early months, there are now signs of a more rapid climb. It'll depend, of course, on some hot weather this summer and gains in industrial production during the last half of the year. But the Pacific Northwest area, which has caused part of the lag, is back in full production after a period of low water.

This could be a banner year for line contractors. A number of them have a larger backlog of work than they did at the same time last year. But they point to the cutback in housing as a possible damper on distribution work.

Public utility commissions will take another look at current rates of return in light of the higher money costs and rises in other expenses. Question is whether present rates are sufficient to attract necessary capital.

Is demand for engineers tapering off? There seems to be fewer "Engineers Wanted" ads in newspapers and other publications. To further improve the situation, utilities will make more efficient use of their technically trained men and put more emphasis on in-service training to bring promising young men into the technical class.

LATE NEWS ▶ **Engineers Joint Council board of directors approves the majority report** of the Review Board-National Water Policy Panel, as published in EW, April 15 p 69.

National Highway Users Conference reports bills to reimburse utilities for highway relocation have been considered in 34 states, defeated in 11, are awaiting gubernatorial action in three, enacted in seven, pending in 14 others.

Atomic Energy Commission signs $1.7-million contract with Nuclear Development Corp of America for research, development, and preliminary design of a liquid sodium, heavy-water moderated reactor system. Pact is intended to establish feasibility of such a reactor. If successful, Chugach Electric Assn, AEC, and NDA jointly would build a 10,000-kw nuclear electric plant in Alaska.

President Eisenhower cuts budget by $5,058,000 by deferring some generating and transmission facilities planned for Bonneville Power Administration.

H. K. Porter Co acquires Federal Wire & Cable Co, Ltd, of Ontario, one of Canada's largest wire and cable firms.

Westinghouse marks largest first quarter in new orders booked of any January-March period in its history. Company reports sales billed during period at $475.5 million with net income of 82¢ a share vs a loss of $1.14 a share during the same period last year. Westinghouse board elects John H. Chiles, Jr, a vice president in charge of the Transformer Division in Sharon, Pa.

Congratulations . . . Black Hills P&L elects J. B. French board chairman, Neil G. Simpson president, H. E. Norman vice president and treasurer, L. Duane Walrafen vice president and secretary, R. G. Asheim vice president-operations . . . **Harry T. Pritchard retires** as president of Indianapolis P&L, is re-elected board chairman. Ottis T. Fitzwater rises to president, Bernard W. Schotters to executive vice president, Edwin L. Cassady to vice president and treasurer . . . **Toledo Edison ups** John K. Davis to executive vice president and assistant general manager, W. A. Marshall to vice president and secretary.

INDUSTRIAL ▶ **Plan wisely for tomorrow's industrial distribution needs.** This advice goes for top management and electrical engineers in general industry and the electric utilities. The specifics are spelled out in our comprehensive special report, "Distribution for Tomorrow's Industry," in this issue **(pp 101-113).**

Packed into these 13 pages is the background and the guiding philosophy for evaluating industrial distribution needs and planning systems that will adequately provide for those needs. You'll see actual figures on the "shut down" losses that result from electrical outages in different types of plants.

You'll find a helpful check-list for guiding the design of an adequate industrial system. And you'll see why "flexibility" and "expandibility" are more important in today's planning than is any attempt to initially install adequate capacity for all future needs.

"Distribution for Tomorrow's Industry" is the kind of report that electrical engineers in industry should show their bosses before they chain it to their own desks tops. It's the kind of report that industrial power salesmen will want to keep for ready reference.

EVENTS ▶ **Business is sticking to its guns on capital spending.** Despite tight money, talk of leveling out, and some fringe pessimism, U. S. industry firmly plans to put 12% more in capital plant than last year. What's even more important is that a survey conducted last month by McGraw-Hill's Economics Department shows that capital spending plans for the year are slightly above those indicated in a preliminary survey last year. For this year, capital spending will hit a record $41 billion. For the next four years, something like $150 billion as compared with $124 billion in the last four years **(p 89).**

Calling all right-of-way men! Electrical World invites you to attend a one-day conference on utility R/W problems **(p 91).**

Chalk up another important power pooling arrangement on your map. This one brings Arizona Public Service, California Electric Power and the Imperial Irrigation District into an international grid **(p 88).**

What happens when a seven-year drought hits a co-op? You'll find a sympathetic and touching story **(p 91)** . . . Polyphase meter course is tailored for electric utility men **(p 93).**

MEETING REPORT ▶ **Southeastern Electric Exchange was urged to form a research committee** by George S. Dinwiddie, president of SEE and New Orleans Public Service, Inc. At the early April meeting in Boca Raton, Fla., members of SEE also were told that the conversion efficiency of nuclear reactors must be considerably improved if nuclear fuels are to measure up as an economical heat source **(p 94).**

Missouri Valley Electric Association is told that a crash nuclear power plant program is a ruse to permit further encroachment on electric company operations. Organization also heard discussion of engineering opportunities and improved techniques for meeting power demands **(p 96).**

GENERATION ▶ **Remove some of the brushes from the exciter on a hydro-generator** and you are apt to actually improve performance of the machine. That was Pacific Gas & Electric's finding after an extensive study. For optimum performance, the brush face temperature should be above 85C to allow a protective film to form on the commutator. Under normal operation with full complement of brushes, the temperatures run considerably below 85C. First of a two-part article tells how the brush face temperatures are raised **(p 117).**

PREVIEW OF THIS WEEK'S ELECTRICAL WORLD

TRANSMISSION ▶ **Soil borings guide transmission line design** on Northern States Power system. The company's engineers find that data obtained from these borings enables designers to choose adequate and appropriate foundations and construction forces to work more efficiently. For two lines requiring some 62 towers, borings were taken at 68 locations. Cost of the boring figured at $190 per location and total boring cost came to 0.9% of the estimated cost of construction **(p 100).**

SUBSTATIONS ▶ **Use of 750-Mva outdoor, metal-clad switchgear** at its new Prospect substation enabled Holyoke Water Power to break the bottleneck on expansion of its 13.8-kv system. One of the first installations of its kind in this country, the switchgear installation is unique in that the outlying supervisory control equipment is contained in an auxiliary compartment **(p 94).**

DISTRIBUTION ▶ **You can find pole numbers in a jiffy** on Ohio Edison system maps. Gimmick is that pole numbers are indexed to conform to sections of the map. It works the same way as locating a town on a regular road map **(p 124).**

Time and labor saving method of testing instrument transformers involves applying test voltages on both windings at the same time. Scheme of Detroit Edison's dielectric test procedure is part of the article **(p 120).**

Special wrench for tightening "wagon wheel" washers in double cross-arm assemblies has been devised by Max Windwehen of Southwestern Public Service **(p 126).**

SELLING ▶ **Electronic scale mounted on large electric crane greatly simplifies weighing** and inventorying of various types of steel stock at plant of Joseph T. Ryerson & Son in Cincinnati . . . Ivory Pine Co formerly burned wood wastes to power its steam engine. Now with an all-electric plant it has found plenty of attractive ways to sell the wastes at a fair profit **(p 135).**

MANAGEMENT ▶ **Electric utilities, too, will go through with their capital spending plans** this year —spending some $4.8 billion as budgeted **(p 161)** . . . For latest financing, rate actions, and legislation see **pages 163, 164.**

PEOPLE ▶ **At Public Service E&G:** Watson F. Tait, Jr, moves up to become executive vice president; Edwin H. Snyder is named vice president for electric operations; Arthur R. Nelson is named general manager of electric department; and Edward R. Eberle becomes general manager of services. At Southwestern Public Service: W. L. Pearson and Roy Tolk are elected vice presidents **(p 166).**

MANUFACTURERS ▶ **Hot balance test pit,** constructed for precision balancing and overspeeding of turbine-generator rotors under temperature conditions simulating actual operations, is now in service at Allis-Chalmers' West Allis Works . . . Rome Cable begins work on $500,000 research center at its main plant . . . Leeds & Northrup will build an economic dispatch computor for Florida P&L **(pp 151, 154).**

NEW EQUIPMENT ▶ **New type printing demand meter** has a reported capacity of 1,000 impulses per demand interval, up to a maximum of 1.5 impulses per second . . . Outage locator sends out radio signals to enable utility personnel to quickly spot a tripped recloser . . . Pocket-size range finder offers quick and easy measurement of distances between 8 ft and 100 ft . . . Insulating material made of flexible straight-weave continuous filament glass fabric coated with an organic modified-silicone resin is reported to have good solvent and heat resistance **(p 138).**

ENGINEERING TRENDS

Reliable service requires more automatic line sectionalizing for higher-voltage distribution primaries than is customary on systems below 5 kv because the larger circuits serve more customers and have greater exposure to trouble. Even the optimum additional sectionalizing may leave the higher voltage system somewhat more susceptible to interruptions.

Reactor controls must make reactor output respond to load changes before nuclear plants can prove themselves as useful power sources for utility systems.

Two 50-Mva units will serve 1-phase 16 2/3-cps railroad load from a 206.6-Mva underground hydro station at Goschenen, Switzerland. These machines, claimed to be largest traction generators, will have rigidly-mounted stators with provision for resilient mounting if operation proves this necessary.

Free-piston gasifiers will drive 36,000-kw gas-turbine plant for Singapore. This electric plant will comprise 6 units of 6,000 kw, each driven by 8 1,000-hp gasifiers exhausting into the gas turbines.

Preparation of thorium in its pure state is difficult because of the high melting point and reactivity of this fertile nuclear material with hydrogen, oxygen, nitrogen, carbon, and other metals, according to The Electric Journal.

Spacers have been used on bundled conductors since 1946 without failure in Sweden where 150,000 of them are now in service.

FROM EDITORS IN THE FIELD

Rubber-tired mobile cranes are economical in pole and transformer yards because they are useful for many other lifting and moving jobs, according to Florida P&L Co.

Exhaust from a 5,000-kw gas turbine will serve as 840F combustion air in coal-fired boiler driving a 12,500-kw steam turbine for Crisp County (Georgia) Power Commission. The combination is expected to be 12% more efficient than the alternative two 7,500-kw steam units.

Four 250-kw submersible silicon rectifiers will supplant a dc substation supplying scattered dc customers in certain downtown areas, according to plans of the Boston Edison Co. Savings from elimination of the manually-operated substation will pay for the new installations within 2 years.

Residential load density in some areas has reached 16,000 kw per sq mile, according to reports from Oklahoma G&E Co.

WE RUN A PRE-VIEW TO GIVE YOU MORE RELIABLE INSULATORS

Ahead of All Other Inspection of Fired Pieces, A Realistic Check is Made on Completely Assembled Samples

These insulators are still warm out of the kiln. By using short-cut methods, fully assembled samples will be under test in a few hours. Before any part of this production batch has been mingled with others, its representatives will have passed a series of special inspections and tests. This will be in the form of *finished insulators,* not simply separate pieces. In this way we pre-view our production. It is one more assurance of an absolutely consistent product.

Naturally, this is no substitute for almost hundreds of tests, measurements, inspections, and checks that follow later. But we know each batch is basically good before all this starts. It's one of the safety measures that show up later in the remarkably high performance records of O-B insulators in the field.

Careful inspection, ingenious inspection, thorough inspection, realistic inspection, all add up to complete reliability. This is one of the unseen extras you get in the package -- at no extra cost -- when you use O-B insulators.

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

TECHNICAL COMPETENCE

Ohio Brass

4820-H

THE HEART OF EVERY (B) INSULATOR

Self-Contained Strength

SAVES MONEY!

All Auxiliary Supporting Structures Eliminated When You Use THOREX Lightning Arresters

All the way -- even above 300 kv -- Thorex lightning arresters are totally self-supporting. No external bracing or superstructure of any kind is needed. Every model is a clean, simple, un-cluttered column.

This is at no sacrifice of strength. Even largest Thorex arresters offer generous safety factor over all recognized requirements for wind resistance and earthquake shock. The smaller, more popular sizes, multiply this safety.

Consider the savings resulting from this self-contained strength. No auxiliary support structures or massive foundations need be built. No bracing insulators need be purchased. No time need be wasted building, adjusting, and aligning external supporting members.

And, with all this simplicity, all this cost saving, you get in addition a protective device meeting or exceeding every published standard, and having added features not elsewhere available. For a bargain installed price you get a premium product!

Is Thorex in your plans for your next station construction? It will be well worth your while to check the specifications and be sure of getting the most for your money.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

4774-H

1945

THE FIRST . . . **FISHER-PIERCE PHOTOELECTRIC LIGHTING CONTROL**

. . . THE LATEST

1957

The year World War II ended, The Fisher-Pierce Company began work with utility engineers to develop photoelectric controls. Automatic, dependable switching of street lighting circuits when illumination was needed, regardless of time of day, season or weather, was the fundamental idea. The Series 61300 was the first of five different, major groups of F-P controls that have followed.

The experience has proved valuable to Fisher-Pierce and customers alike. Backed by an organization of more than 650 people, F-P today offers photoelectric lighting controls for all purposes . . . extensive sales and engineering services . . . research, development and production facilities to solve specific photoelectric/electronic equipment problems you may have. Your inquiry about F-P products, who uses them, and how you may use our development facilities for your own electronic equipment requirements, is welcomed.

THE FISHER-PIERCE CO., INC.

82 PEARL STREET, BOSTON 85, MASSACHUSETTS

An important message from Southwire about aluminized steel wire

FOR ACSR CORES, GUY STRAND, MESSENGER AND GROUND WIRES, TELEPHONE AND STATIC WIRES

SOUTHWIRE is proud to be among the first in the industry to offer *aluminized steel wire** in our full line of steel wire products. To electric and telephone systems plagued with costly rust and corrosion problems, this new product offers added protection at substantial savings. Here are the facts:

Laboratory tests indicate Aluminized Steel compares most favorably in corrosion resistance to Class B Zinc coated steel wire.

Field tests indicate Aluminized Steel is equal or superior in holding or slippage characteristics to galvanized strand.

Aluminum oxide protection retards penetration of most corrosive media.

It offers electrochemical protection in the event that the coating should become nicked or pierced.

Aluminized strand can be stretched or sagged with the same tables as for comparable galvanized strand.

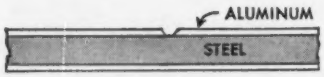
Wherever salt air or industrial atmospheric conditions present a rust or corrosion problem, SOUTHWIRE Aluminized Steel Wire products warrant your serious consideration. Our representatives will be glad to discuss the matter with you, or your inquiry will be welcomed at our plant.

*Acco Aluminized

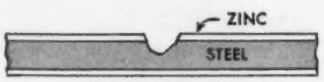
STRENGTH OF STEEL • CORROSION RESISTANCE OF ALUMINUM

"HOT-DIP ALUMINUM COATED"

ELECTROCHEMICAL PROTECTION OFFERED BY ALUMINIZED WIRE



Should the coating become nicked or pierced, exposing a small area of steel, the position of Aluminum in the Electromotive Force Series of Elements in relation to iron or steel is such that slow and long-range Anodic protection is afforded.



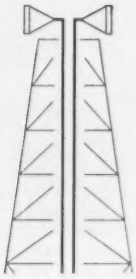
Zinc to steel galvanic action is similar to that of aluminum to steel; however, since zinc oxide is far more readily soluble by the elements, the zinc coating is rapidly sacrificed.

Southwire Company

SOUTHWIRE

TErrace 2-6311 CARROLLTON, GEORGIA

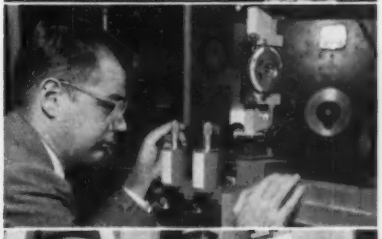
What kind of men develop microwave highways?



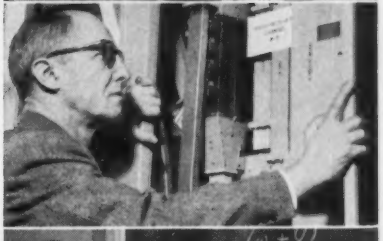
The great microwave systems that relay telephone conversations along with television programs from coast to coast will have to work harder than ever to meet growing demands for service. But at Bell Laboratories scientists have been making important advances in the art of microwave communication. These advances are being applied in the development of a new and more efficient system in which single beams of microwaves will carry simultaneously many more telephone conversations and television programs than is now possible.

The development of the new system demands the varied skills of men in many fields of science and engineering. Just a few of the specialists necessary are . . .

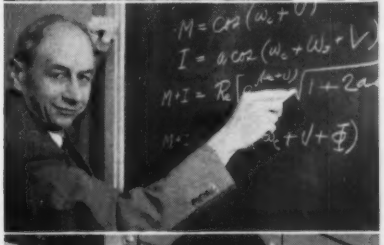
PHYSICISTS like J. A. Weiss, Ph.D. in Physics, Ohio State, to harness the properties of ferrites in new ways for better control of the transmission of microwaves.



MICROWAVE ENGINEERS like P. R. Wickliffe, M.S. in E.E., M.I.T., to design new circuitry. Microwaves must be conducted, controlled and amplified through waveguides which resemble pipes.



MECHANICAL ENGINEERS like W. O. Fullerton, B.S. in E.E., Iowa State, to embody new principles in designing the many structures and devices used in microwave telephony—with all parts feasible to manufacture, practical to install and easy to maintain.

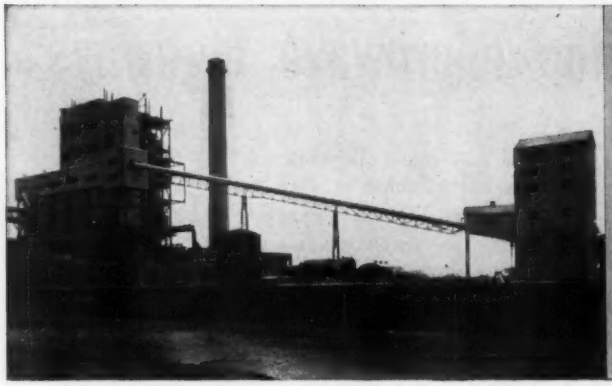


SYSTEMS ANALYSTS like J. P. Kinzer, M.E., Stevens Institute, for over-all system planning and prediction. Mr. Kinzer works with numerical quantities and characteristics to predict on paper the performance of an operating system. What will it do? How must it perform to meet the needs?

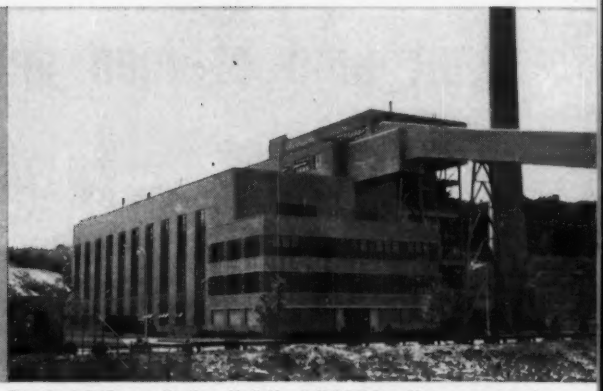
ELECTRONIC ENGINEERS like B. C. Bellows, B.S. in Engineering, Cornell, for the development of "watch-dog" equipment to protect against failure. Protective devices must operate automatically in split seconds to maintain uninterrupted service.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

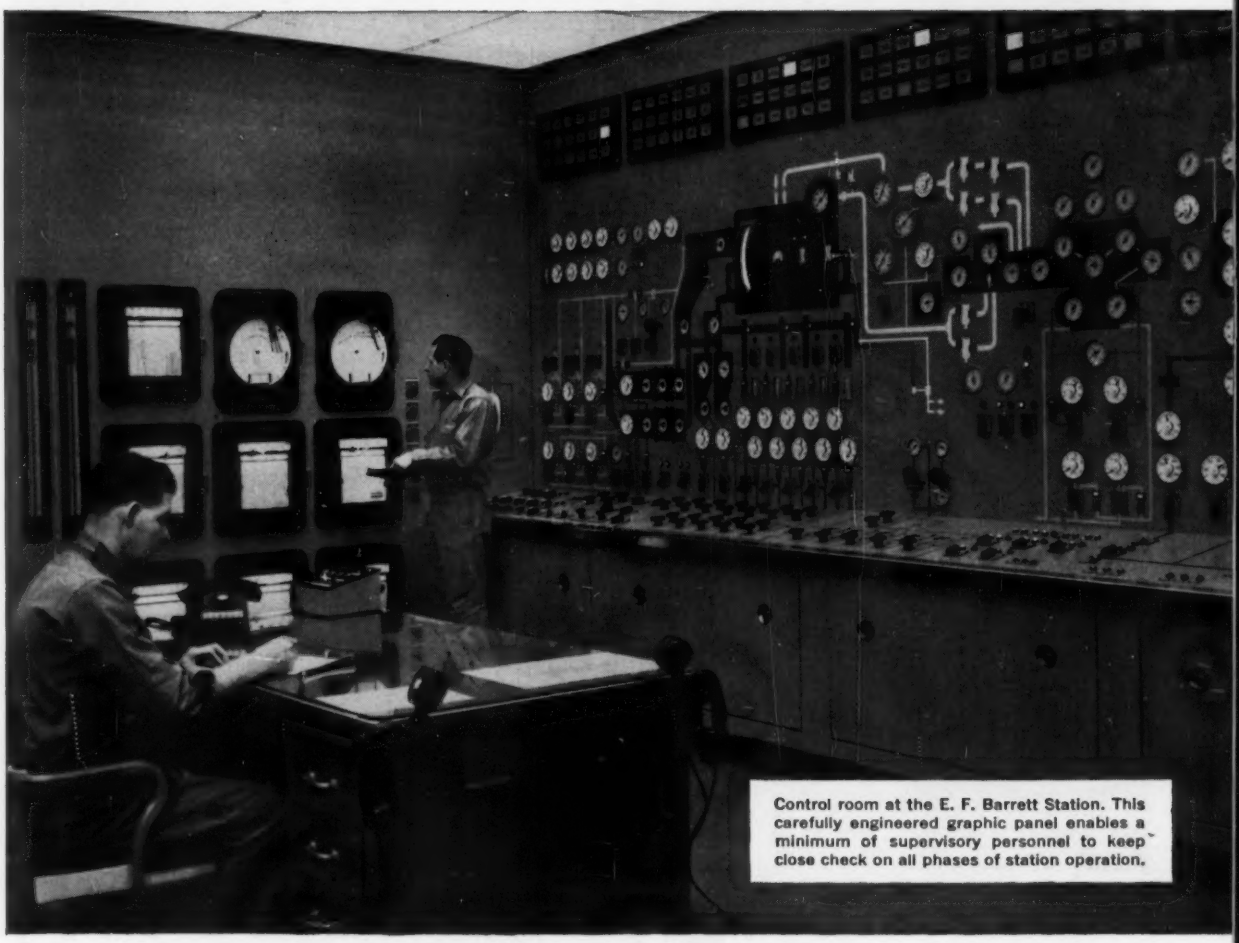


The E. F. Barrett Station, completed in 1956. This station has Hagan combustion control, three-element feedwater control, and primary metering. Designed to take full advantage of the latest construction techniques, a major part of the station is outdoors, following the pattern established at the Port Jefferson Station.

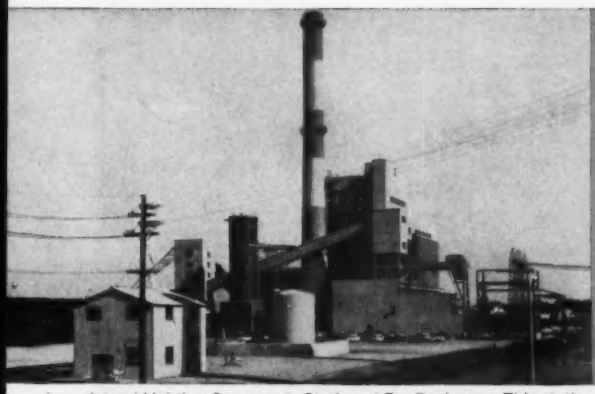


The Port Jefferson Station. Unit No. 1 (1949) has Hagan combustion control, as does Unit No. 2 (1950). Unit No. 3 will be equipped with Hagan Combustion Control, three-element feedwater control, and primary metering. The feedwater control system will include Hagan compensated drum level control.

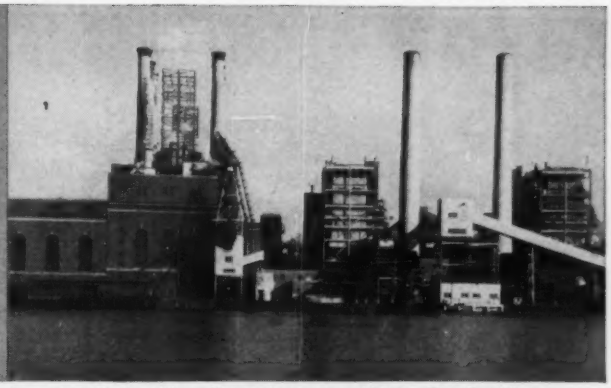
since 1942—Long Island



Control room at the E. F. Barrett Station. This carefully engineered graphic panel enables a minimum of supervisory personnel to keep close check on all phases of station operation.



Long Island Lighting Company's Station at Far Rockaway. This station went into commercial operation in 1954. It has a Hagan combustion control system. All of the stations, with the exception of Port Jefferson, are equipped with Hagan Remote Switching, providing a short direct signal path from controller to positioner.



Glenwood Station. Here Hagan has a long history. The first Hagan combustion control system was installed on Boiler #5 in 1942. Since then the record runs as follows: 1946—Boiler No. 6, 1952—Unit No. 4, 1954—Unit No. 5. Units No. 4 and No. 5 fire a combination of pulverized coal with oil or gas.

Lighting chooses HAGAN

Performance is the reason why Long Island Lighting Company now has Hagan combustion control systems on seven boilers, with an eighth on order. The last two of these are also equipped with Hagan three-element feedwater control. Management, engineers, and operating personnel alike have found that the simple, sturdy construction, high accuracy, and reliable operation of Hagan equipment contribute materially to station efficiency.

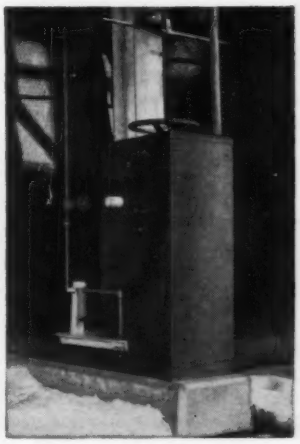
Hagan operating units perform well out-of-doors, and Hagan remote switching provides fast response to changing steam demands. Hagan three-element feedwater control includes drum level compensation which permits accurate indication and automatic control of drum level, even during start-up and shutdown.

Long Island Lighting Company is one of the nation's fastest growing utilities. The first installation of Hagan equipment was an automatic combustion control system for the #5 boiler at their Glenwood Station. On their newest unit, the very modern 180 Mw. E. F. Barrett Station, Hagan systems include automatic combustion control, three-element feedwater control, and metering.

Hagan's 39 years of experience in the design and manufacture of automatic controls for all types of boilers provide a unique background for the solution of control problems. A Hagan representative will be glad to discuss your requirements.

HAGAN CHEMICALS & CONTROLS, INC.

HAGAN BUILDING, PITTSBURGH 30, PENNSYLVANIA
DIVISIONS: CALGON COMPANY • HALL LABORATORIES



Hagan Power Positioner for induced draft fan discharge dampers. The fully-enclosed Power Positioner is designed to provide accurate, reliable positioning, whether indoors or outdoors. Station operators are particularly pleased with the integral locking feature of the Hagan Power Positioner.

You can see why linemen prefer

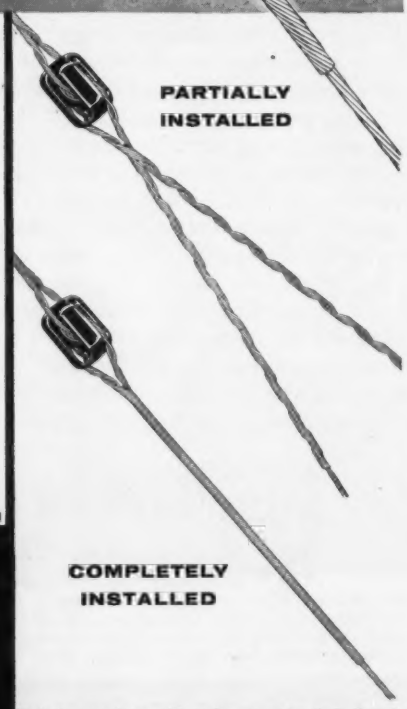
GUY-GRIP Dead-Ends

Linemen are enthusiastic!

PLP GUY-GRIP dead-ends are the easiest, fastest and safest method yet devised for dead-ending strand.

Installation is easy because it takes just one unit, no moveable parts, no bolts or clamps to tighten. It's fast. All you do is hand-wrap the dead-end legs around the strand.

And it's safe. You can see at a glance that the installation is completed and thus secure. Linemen make better time, take pride in their work.
Dept. No. PR1C



PX-81

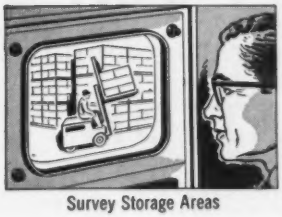
PREFORMED LINE PRODUCTS CO.
5349 ST. CLAIR AVE. • CLEVELAND 3, OHIO
TELEPHONE CLEVELAND [illegible]

Made in accordance with or for use under U. S. Patent No. 2,761,273; other patents issued and pending.

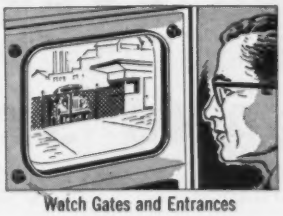
Pin-Point Control for Plant and Property Protection

...with High-Definition

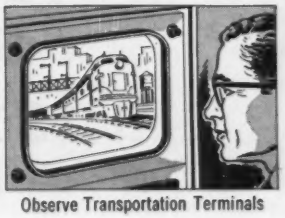
PHILCO *Industrial TV*



Survey Storage Areas

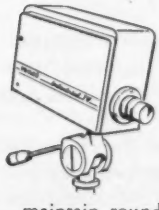


Watch Gates and Entrances



Observe Transportation Terminals

Watch for Fires



Compare the picture clarity of Philco Industrial TV before you order ANY closed-circuit system. Here is picture quality and detail that's excellent . . . even for applications where ITV never could be used before.

From a central control point, one employee can guard your entire premises . . . maintain round-the-clock surveillance of even the most hazardous or inaccessible locations. And operating cost is negligible . . . Total hourly power consumption for an entire system actually amounts to less than the price of a pack of cigarettes or an ice cream soda.

Virtually any combination of on-the-spot cameras and centrally-located monitors can be used. You can quickly mount an inexpensive, lightweight Philco Vidicon camera to cover each important field of vision in your security and protection network. Philco's complete line of accessories permits maximum flexibility for your system. Remote pan and tilt . . . remote iris and focus . . . Auto-Zoom lenses . . . lens turrets . . . weather-proof housings . . . explosion resistant housings . . . assure complete versatility and adaptability to any installation.

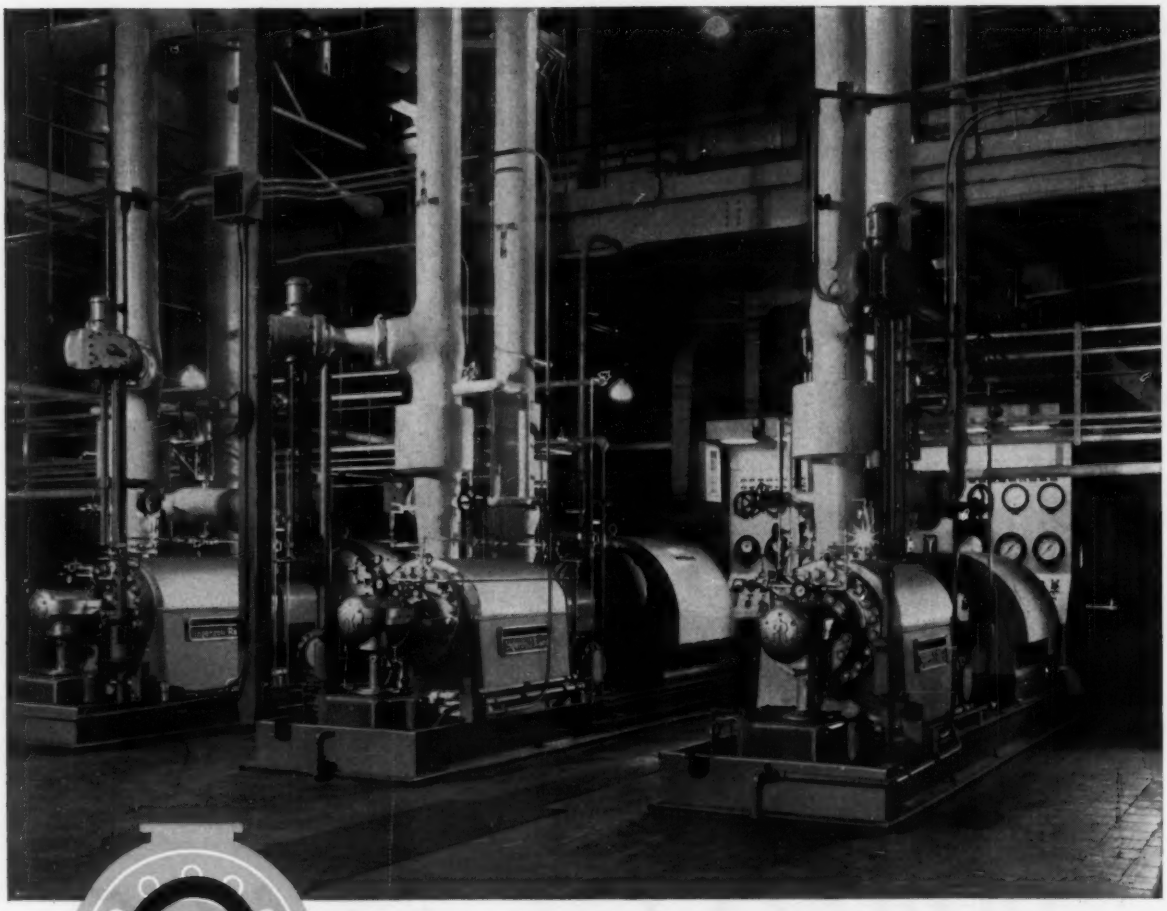
To pin-point property protection for your company . . . examine . . . compare . . . specify Philco ITV.

Send for illustrated brochure, describing Philco ITV.

PHILCO®

GOVERNMENT AND INDUSTRIAL DIVISION
PHILADELPHIA 44, PENNSYLVANIA

In Canada: Philco Corporation of Canada Limited, Don Mills, Ontario



6 I-R BOILER FEED PUMPS

now serving ALL THREE Generating Units at

MUSTANG STATION

of Oklahoma Gas & Electric Co.

At its Mustang Station, Oklahoma Gas & Electric Company looks to Ingersoll-Rand boiler-feed pumps for the dependable, efficient supply of feedwater to all three of the station's generating units.

Pictured above are three of the four 1100-gpm, 1250-psi discharge units which serve 50-MW Units No. 1 and No 2. The new 100-MW Unit No. 3, put into operation in 1955, is served by another pair of Ingersoll-Rand boiler-feed pumps, each designed for 1770-gpm, 1900-psi discharge. While each generating unit is served by two pumps, each pump is capable of handling full unit load.

All six boiler-feed pumps are of proven Ingersoll-Rand heavy-duty, double-case design, featuring "unit-type" rotor construction to facilitate inspection and servicing.

Ingersoll-Rand boiler-feed pumps are the Power Industry's first choice where efficient performance and maximum dependability are prime considerations. They are available for all capacities and pressures, for any central station or industrial application. Your local I-R engineer can give you full details.

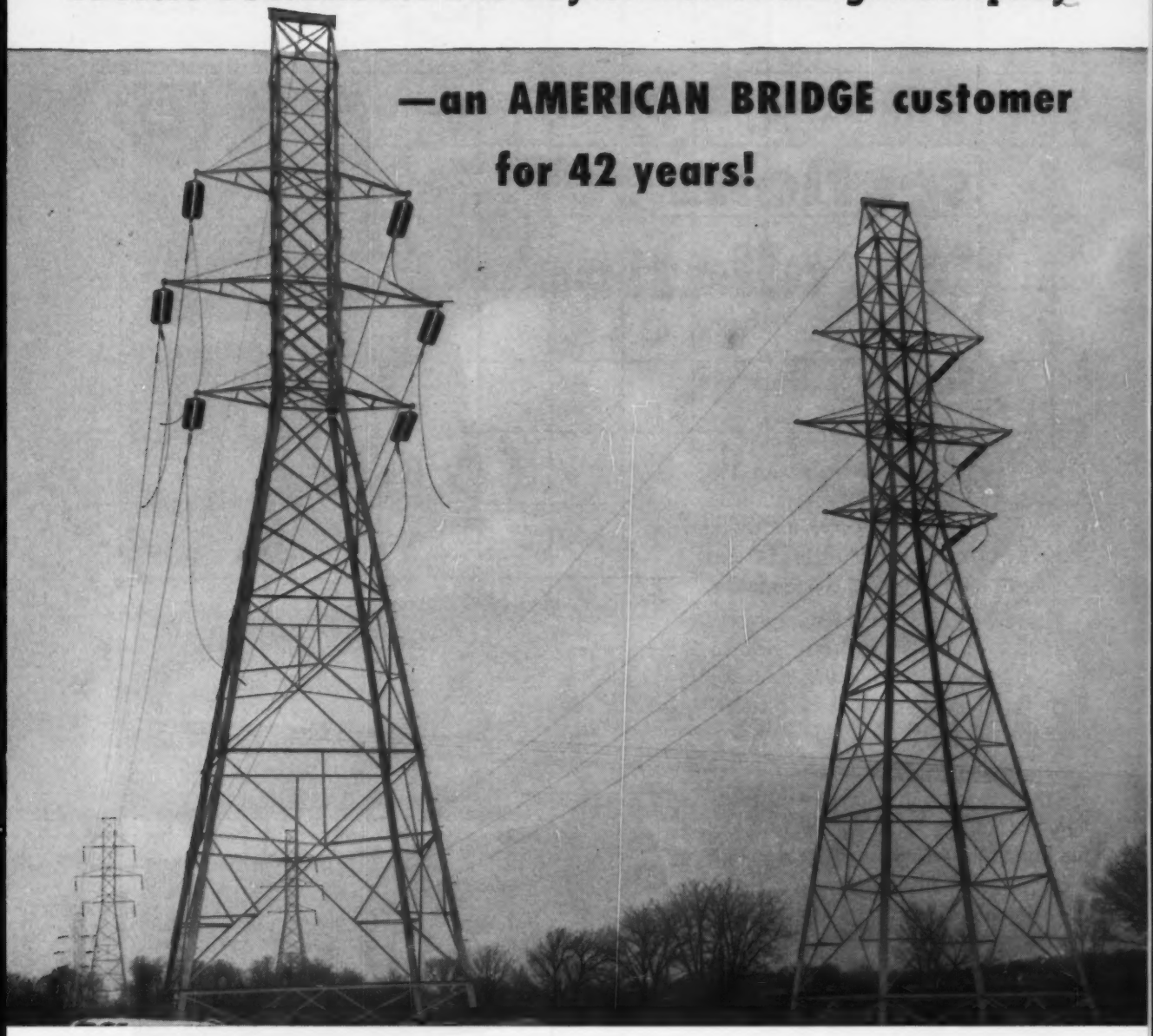
Ingersoll-Rand

10-571

11 BROADWAY, NEW YORK 4, N.Y.

COMPRESSORS • GAS & DIESEL ENGINES • PUMPS • AIR & ELECTRIC TOOLS • CONDENSERS • VACUUM EQUIPMENT • ROCK DRILLS

14 More TOWERS for The Dayton Power & Light Company



THE TOWERS SHOWN ABOVE are on the new 69KV double-circuit Airway-Wright Field Lines of The Dayton Power and Light Company—*a customer of American Bridge since 1915.* Built to meet the increased electrical requirements at the Wright-Patterson Air Force Base, these comparatively short lines (running only 4800 feet) connect with the Air Base's own recently constructed transmission system. These towers were also furnished by American Bridge.

While the new line will operate at 69KV, it is actually a 132KV line, since it has sufficient insulation level to handle safely the higher voltage any time in the future.

Each of the 100′ suspension towers will support six conductors of 1,351,500 cm A.C.S.R. 45/7 over an average span of 800′. Typical earth anchors, as supplied by American Bridge to this industry, were used for both the suspension and strain towers.

American Bridge has been designing and fabricating transmission towers since 1911. *(Note that we have served Dayton Power and Light almost from the very beginning.)* We have the experience, the facilities and the know-how to furnish you with quality structures *competitively* and on time. It will pay you to call our tower experts on your next job.

AMERICAN BRIDGE DIVISION, UNITED STATES STEEL CORPORATION · GENERAL OFFICES: 525 WILLIAM PENN PLACE, PITTSBURGH, PA.

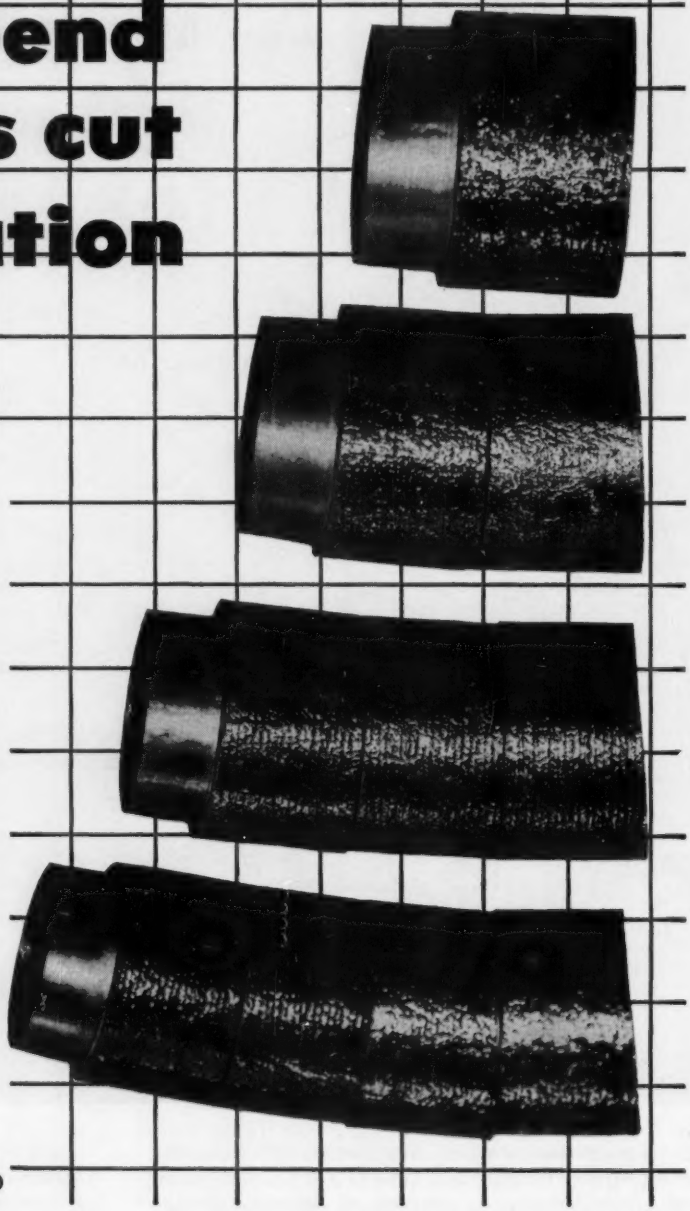
Contracting Offices: AMBRIDGE · ATLANTA · BALTIMORE · BIRMINGHAM · BOSTON · CHICAGO · CINCINNATI · CLEVELAND · DALLAS · DENVER · DETROIT · ELMIRA · GARY HOUSTON · LOS ANGELES · MEMPHIS · MINNEAPOLIS · NEW YORK · ORANGE, TEXAS · PHILADELPHIA · PITTSBURGH · PORTLAND, ORE. · ROANOKE · ST. LOUIS · SAN FRANCISCO · TRENTON

UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS **AMERICAN BRIDGE**

UNITED STATES STEEL

These bend sections cut installation costs



Orangeburg 5° Bend Sections are the "on-the-job" answer to special bend problems. They get over, under or around those unforeseen obstructions . . . and do it easily and economically.

Crossovers . . . transformations . . . offsets . . . can be made in the field by joining sections together to obtain the desired direction change. No costly delays . . . no special bends needed.

Orangeburg 5° Bend Sections* are another reason why Orangeburg Fibre Conduit is the ideal protective raceway for underground electrical cables.

Distributed by Graybar Electric Company and General Electric Supply Company. Branches and stocks in principal cities.

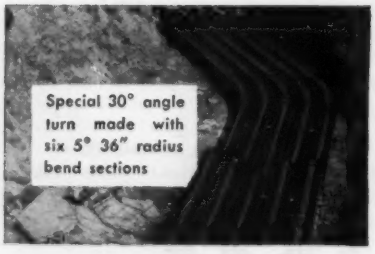
Write Dept. EW-47 for Bulletin S.E.C.

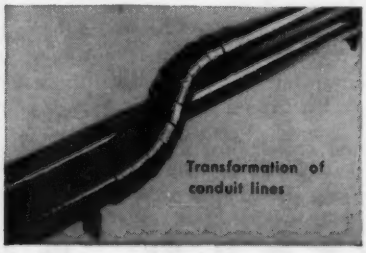
**Made for Orangeburg Standard Conduit only.*

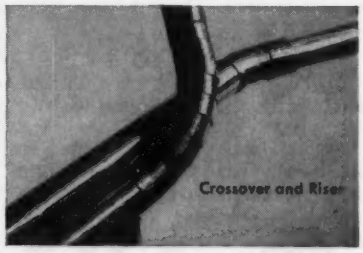
ORANGEBURG MANUFACTURING CO., INC.
Orangeburg, N. Y. Newark, Calif.

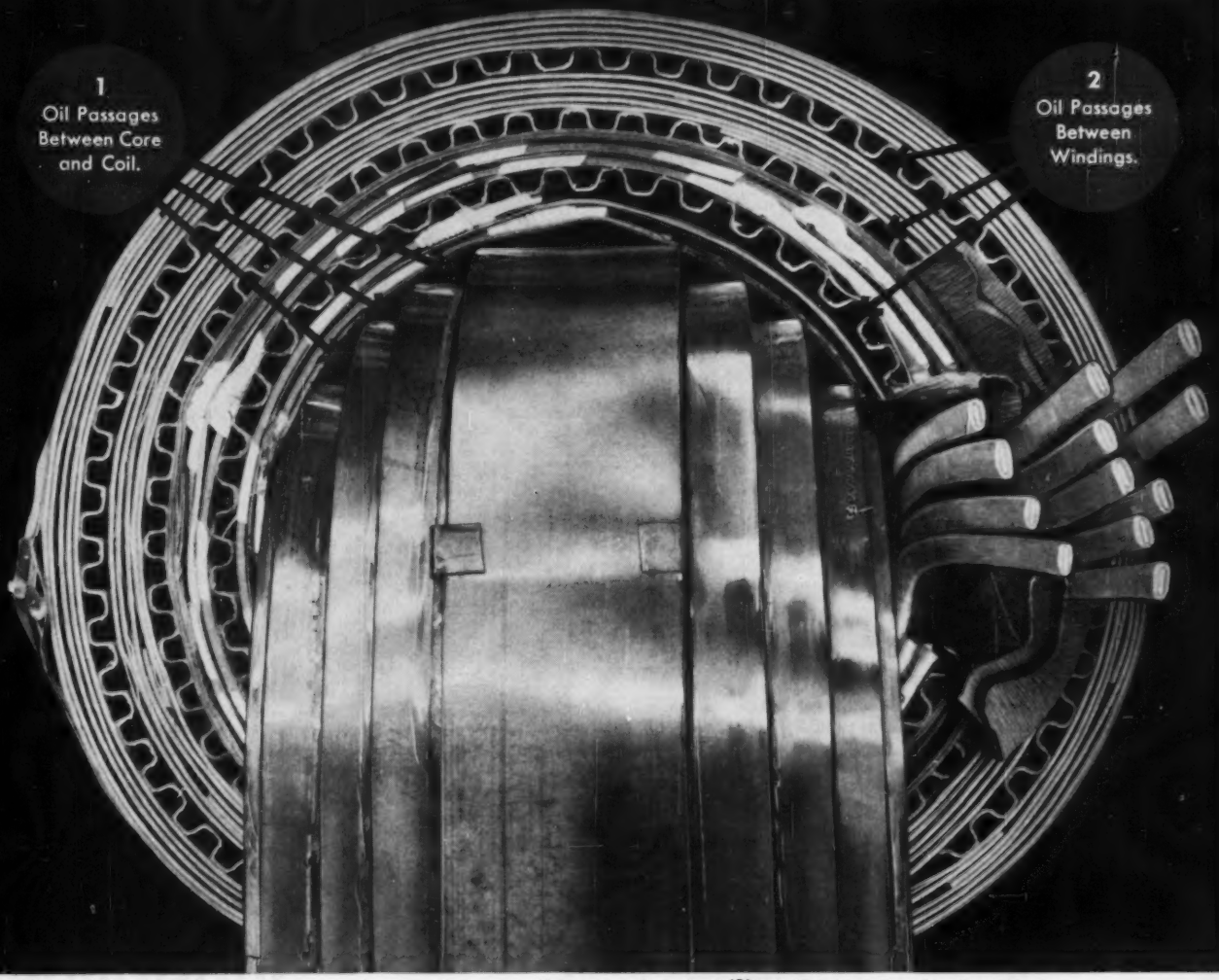
ORANGEBURG®

FIBRE CONDUIT PROLONGS CABLE LIFE









L-M Round-Wound Transformers have natural oil passages between cruciform core and round coil **(1)** to help dissipate heat from the coils more rapidly. In addition, ducts provided by spacers placed between windings **(2)** and between layers in most sizes provide additional oil circulation.

Why More Customers Are Selecting L-M Round-Wound® Transformers

Many factors enter into transformer selection. Here are some of the reasons for the great increase in customer preference for L-M's obround-shape Round-Wound transformers.

Balanced Performance: The core is a continuous wound strip of oriented steel. Coils are wound directly onto this core. Since the core is not cut, unwound, or disturbed in any way after annealing, there are no air gaps to break up the flux. This results in low exciting current and core loss.

The wound-core, round-coil design permits fewer winding turns and smaller turn diameter. This results in low impedance, and provides better regulation at all power factors.

Higher Uniform-Impulse Level: Round coils are wound into shape. Therefore, insulation is not damaged by malleting into rectangular shape. Coils have longer creepage distance between windings and between leads.

Higher Short-Circuit Strength: Round coils are not stressed out of shape under high radial short-circuit forces. Strong steel frame, heavy clamping bolts, sturdy maple blocks and varnished coils prevent axial movement.

Higher Short-Time Overload Capacity: Round coils and the cruciform cross-section core expose large surfaces to cooling oil. The result is relatively low hot-spot temperatures, which add considerably to high short-time overload capacity.

Additional Capacity on Pole: L-M's new obround tank design makes the unit smaller and lighter, with shorter moment arm from the pole. This combination reduces bending moment on the pole and crossarms, and thus greatly increases potential capacity of existing transformer structures.

Get Complete Information

Ask your L-M Field Engineer for complete information and bulletins on L-M's Round-Wound Transformers. Or write Line Material Company, Transformer Division, Zanesville, Ohio.

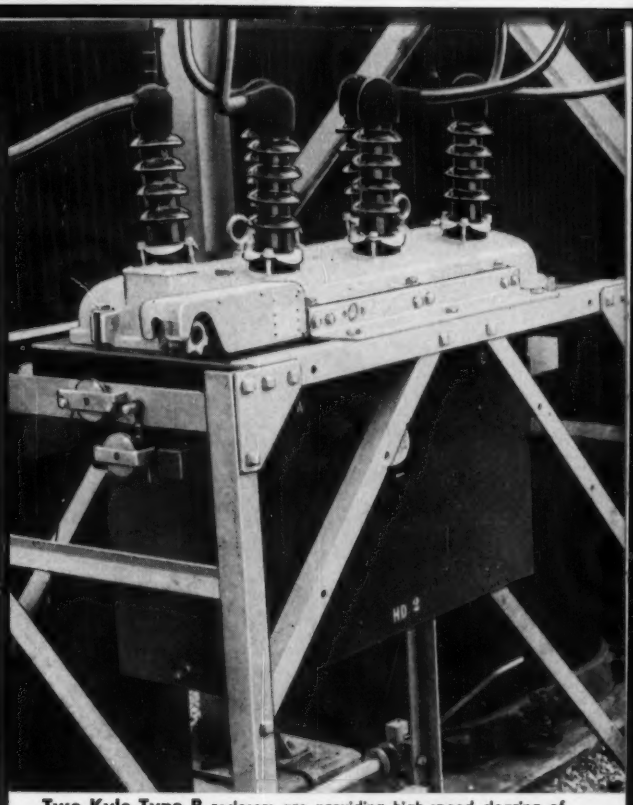
286-R

LM® **LINE MATERIAL**
McGRAW-EDISON COMPANY

Analysis of Savings Using Kyle Reclosers for Five Years*

	Savings on 100 Substations	
I. Initial Investment Costs		
A. At substation. A Type R OCR as compared with an equivalent OCB with AC tripping and reclosing.		
1. Initial savings in equipment costs favoring each OCR—$3227.00. Total savings for 100 substations for 5 years— 2 x 5 x 100 x $3227/20.....	$161,350.	
2. Initial savings in labor costs to install transformers and wiring necessary to operate OCB—$30 per OCR. Total savings for 100 substations for 5 years— 2 x 5 x 100 x $30/20.....	1,500.	
Total initial investment savings with OCR's		$162,850.
B. On distribution feeders with 5 sectionalizing points per feeder.		
1. Equipment costs of 3 OCR's and 2 sectionalizers exceeding that of 5 fused cutouts = $491. Additional costs to utilize self-protective scheme for 200 feeders for 5 years = 5 x 200 x $491/20.....(—)	$ 24,550.	
2. Labor costs of installations. OCR exceeding that of fused cutout = $15. Additional cost to utilize self-protective scheme for 200 feeders for 5 years = 5 x 200 x $15/20.....(—)	750.	
Total additional costs of OCR's and sectionalizers over fused cutouts.....		— 25,300.
C. Net savings in initial costs with OCR's....		$137,550.
II. Operating Costs (estimated 9 outages per feeder through transient conditions annually)		
A. Savings in frequency and duration of service trips resulting from transient faults		
40 man-hours @ $5/hr. per feeder.	$200.	
25 truck hours @ $1/hr. per feeder	25.	
Cost of fuse links per feeder.....	5.	
Total cost of transient outages per feeder.....	$230.	
Total 5-year cost for 100 substations = 5 x 2 x 100 x $230.....	$230,000.	
B. Increased revenue resulting from reduced outages. 1500 KWH per outages per feeder for 5 years through loss of service @ 2¢ per KWH = 1500 x 2 x 100 x 5 x $.02.....	30,000.	
C. Total savings from transient fault protection for 5-year period.....		$260,000.
III. Maintenance Costs		
A. OCR and sectionalizer maintenance cost @ $25 per unit annually = $25 x 5 x 2 x 100 x 5.....(—)	$125,000.	
B. OCB additional relay calibration costs @ $25 per unit annually = $25 x 2 x 100 x 5.....	25,000.	
C. Total additional costs of OCR and sectionalizer maintenance for 5 years.....		— $100,000.
IV. Carrying charges (conservatively estimated as 10% annually of initial capitalized investment)		
A. At substation. Savings represented by OCR's = ($3227 + $30) x 2 x 100 x 5 x .10.....	$325,700.	
B. On line, additional cost of automatic scheme = ($15 + $491) x 2 x 100 x 5 x .10....(—)	50,600.	
C. Savings in carrying charges with OCR's and sectionalizers.....		$275,100.
V. Subtotal.....		$572,650.
Additional savings resulting from Transient Fault protection		
VI. Savings realized by elimination of conductor and equipment damage through extra-fast clearing on heavy faults.....		$?
VII. Value of improved public relations realized through better continuity of service.....		$?
VIII. TOTAL SAVINGS.....	**Well over half a million dollars!**	

**Costs are conservative estimates based on the best available information from utilities. System used to illustrate average installation consisted of 100 substations each with two 15 kv feeders, and amortized in 20 years.*



Two Kyle Type R reclosers are providing high-speed clearing of 13.8 kv feeders for transient fault protection and automatic disconnecting of permanent faults with minimum substation investment.

How Heavy-Duty Substation

The application of Kyle reclosers as the automatic disconnecting device in substations eliminates the relatively high costs of circuit breakers and associated substation equipments. This alone offers savings of a half million dollars or more in five years, based on 200 feeder positions.

Lower Initial Costs

Initial investment in Type R recloser equipment of equivalent rating will result in approximately $3,000 savings per feeder. In addition, field reports indicate that labor for installing Type R reclosers is about 50% of that for circuit breakers. The maintenance cost for reclosers is also lower than for circuit breakers.

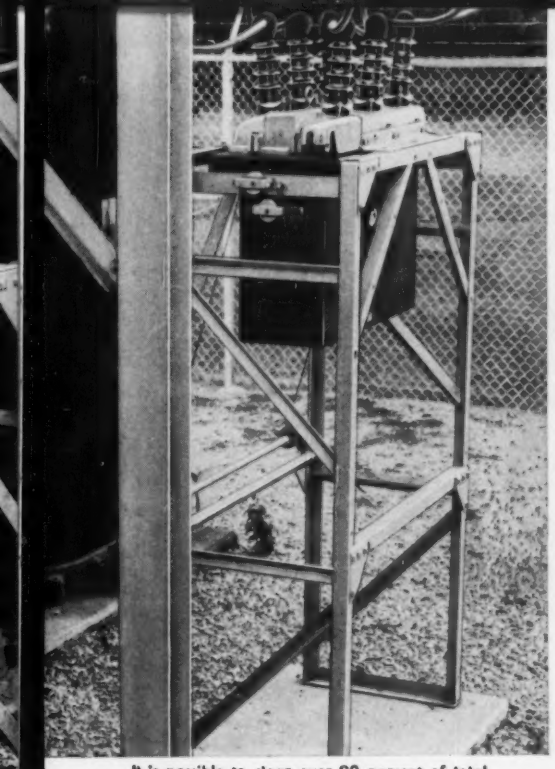
Fewer Outages

L-M Kyle reclosers can also be justified as a fault-protective device that will reduce the number of outages caused by transient or non-persistent causes. Kyle reclosers have extremely fast opening characteristics, clearing circuit in less than 2 cycles, which minimizes conductor burndown and increases service continuity.

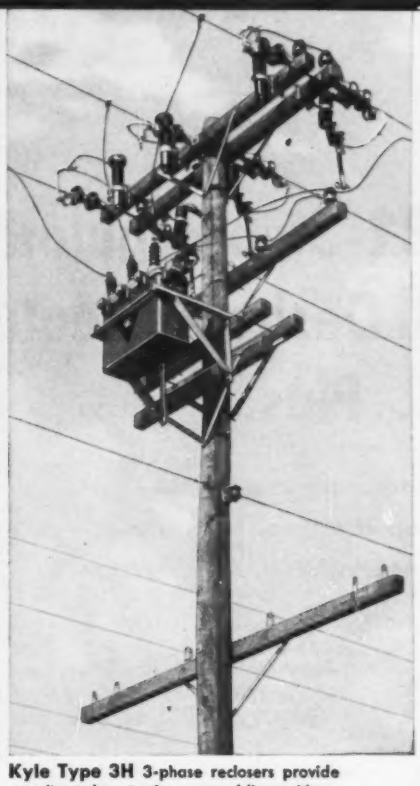
Compare the figures at the left with your construction and operating costs and see how you can save over a half million dollars with Kyle reclosers.

LINE MATERIAL

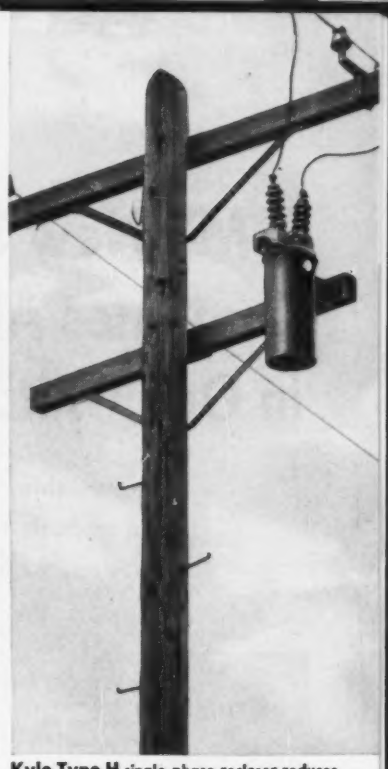
McGRAW-EDISON COMPANY



It is possible to clear over 90 percent of total circuit faults and reduce permanent faults with high-speed Kyle reclosers.



Kyle Type 3H 3-phase reclosers provide coordinated protection on rural lines with up to 1250 amperes at 14.4 kv. Where faults persist, recloser locks open on all 3 phases and confines trouble to a small area.



Kyle Type H single-phase recloser reduces the number of outages on rural lines caused by conductors whipping together on long spans, small branches grounding a conductor, or a lightning discharge.

Kyle Reclosers Reduce Investment And System Operating Costs

L-M high-speed reclosers provide better service continuity and lower operating costs by reducing conductor burndown caused by transient or non-persistent faults on the system. It is possible to clear over 90 percent of total circuit faults and reduce permanent faults with high-speed Kyle reclosers. Such faults are often caused by lightning, arrester flashover, tree limbs shorting the conductors, or conductors whipping together on long spans.

Eliminate the Shaded Area

The shaded area in the chart at right represents the additional fault-clearing ability of L-M high-speed Kyle reclosers. Kyle reclosers clear transient or non-persistent faults on the circuit with no significant damage to the system or interruption of service.

All Kyle reclosers can be coordinated in series to provide complete transient protection over entire distribution system.

Get Complete Information

Ask the L-M Field Engineer for more information on how Kyle reclosers can be profitably applied to your system. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

282-B

Kyle® Reclosers

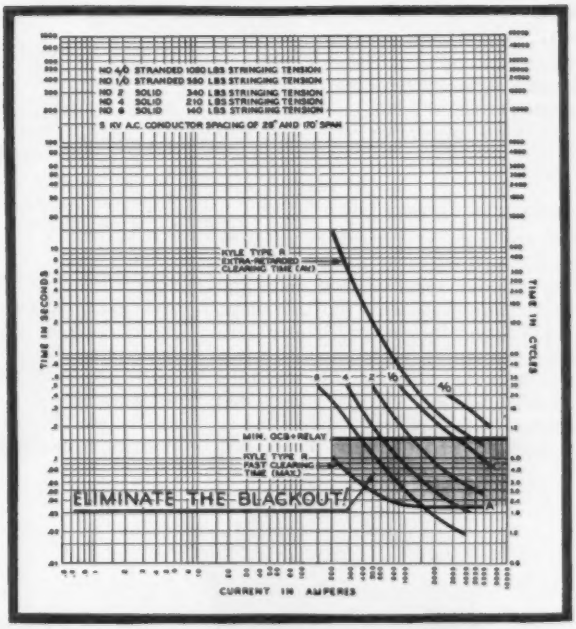

NO 4/0 STRANDED 1080 LBS STRINGING TENSION
NO 1/0 STRANDED 560 LBS STRINGING TENSION
NO 2 SOLID 340 LBS STRINGING TENSION
NO 4 SOLID 210 LBS STRINGING TENSION
NO 6 SOLID 140 LBS STRINGING TENSION
5 KV A.C. CONDUCTOR SPACING OF 28" AND 170" SPAN
KYLE TYPE R EXTRA-RETARDED CLEARING TIME (MAX)
MIN. OCB+RELAY
KYLE TYPE R FAST CLEARING TIME (MAX)
ELIMINATE THE BLACKOUT!
TIME IN SECONDS
TIME IN CYCLES
CURRENT IN AMPERES

Chart shows primary line burndown characteristics for weatherproof wire. It also gives the maximum clearing time for high-speed Kyle reclosers and minimum clearing time for the average circuit breaker plus relay time. The shaded area represents the additional protection that can be obtained with Kyle reclosers in place of circuit breakers.

L-M's New 32-Step Regulator Combines All Desirable Features in One Unit...Plus:

- **reliable, accurate regulation**
- **smooth tap changes, long life**
- **ease of installation and maintenance**

by **N. K. DELANEY**
Product Manager,
Capacitors and
Regulators, Line
Material Industries

Line Material has designed into one compact, efficient regulator all the desirable features found in all other standard makes—plus a few L-M "exclusives."

Sensitive Voltage Control

L-M uses an induction disc-type contact-making voltmeter for reliable, accurate voltage control. The unit is very sensitive, and easily adjustable to a band width of from plus and minus ¾ to plus and minus 6 volts. An integrated time-delay device is used to control the tap-change operation. The time delay can be adjusted independently on both "raise" and "lower" through a range of from 10 to 120 seconds.

Maximum Contact Life

The tap-changing mechanism on L-M's new 32-step regulator is designed to assure smooth operation and maximum contact life. The speed of the tap changer is hydraulically controlled to assure minimum arcing. This, plus a reactor which bridges across adjacent taps during operation, permits smooth tap changes, without current interruption or voltage dip.

Easy to Inspect

The complete internal assembly of the regulator is suspended from the cover to simplify untanking for periodic inspection and maintenance. This desirable feature permits you to inspect all mechanical and electrical parts quickly and easily without draining oil or dismantling the unit.

Less Bending Moment On Pole

The L-M exclusive obround tank design makes the unit smaller, lighter, with shorter moment arm distance from the pole. The unit is easier to handle and install, and the design substantially decreases the total bending moment on the pole.

Greater Current Capacity With ADD-AMP Feature

It is possible to increase the load-carrying capacity of L-M's new regulator up to 160% of its normal rating by reducing the regulation to ±5%. The range of regulation can be reduced externally without de-energizing the regulator.

Get More Information

Ask your L-M Field Engineer for more information on L-M's new 32-step regulator—the regulator with all the best operating and convenience features available on any and all other pole-type regulators. Or write Line Material Industries, Milwaukee 1, Wisconsin.

301

Bushings are corona-free, and are designed for minimum radio interference.

Moving contacts and arcing tips of stationary contacts are made of arc-resistant copper-tungsten alloy to assure long contact life.

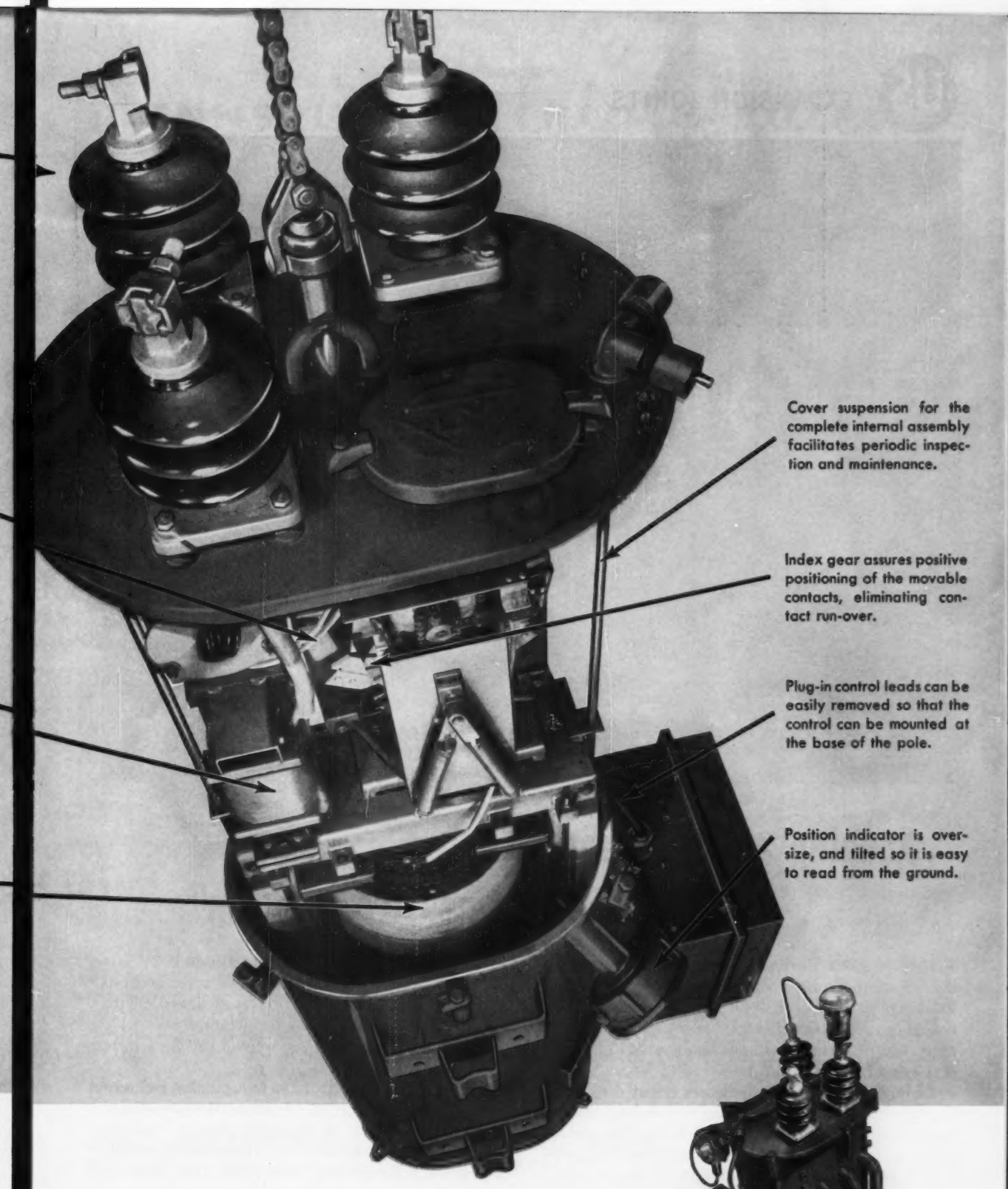
Bridging reactor provides smooth tap changes . . . no current interruption or voltage dip.

L-M's exclusive Round-Wound core-coil assembly provides a balance of low copper loss, low exciting current, and low core loss.

Available Ratings

2500 volts . . .
100, 150 and 200 amperes
5000 volts . . .
50, 100, 150 and 200 amperes
7620 volts . . .
25, 50, 75, 100, 150 amperes

LINE MATERIAL Industries
McGRAW-EDISON COMPANY



Cover suspension for the complete internal assembly facilitates periodic inspection and maintenance.

Index gear assures positive positioning of the movable contacts, eliminating contact run-over.

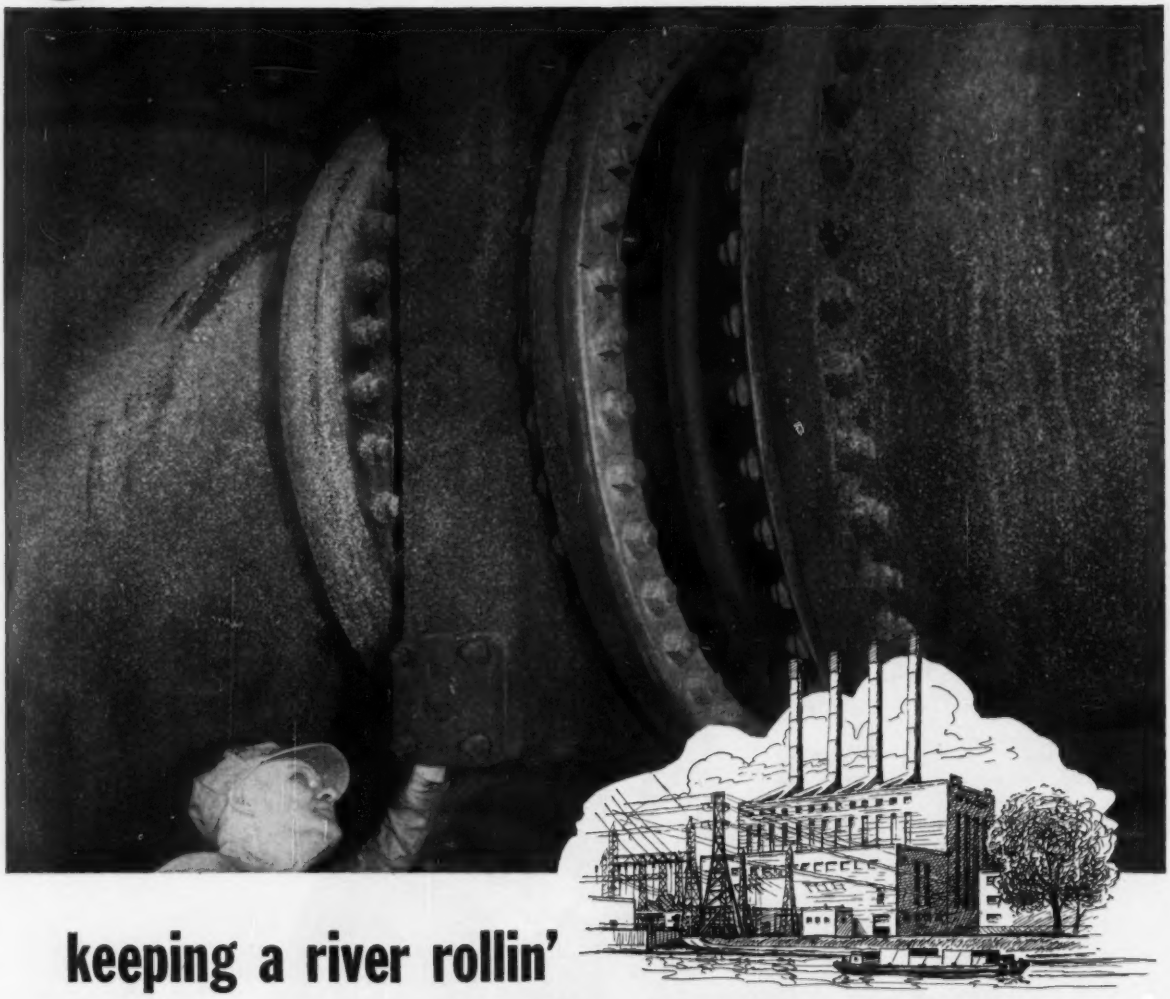
Plug-in control leads can be easily removed so that the control can be mounted at the base of the pole.

Position indicator is oversize, and tilted so it is easy to read from the ground.

Regulators

McGRAW EDISON

EXPANSION JOINTS



keeping a river rollin'
and the pipes from rockin'

A river of 390,000 gallons of water per minute rolls through the four surface condensers in Niagara Mohawk Power's plant at Oswego, New York. Here is generated enough power to heat 384,000 household steam irons every hour. Ravenous furnaces consume 3600 tons of coal every 24 hours at full load.

The piping in Niagara's condenser system can't rock or rattle itself to death despite the tremendous capacities and pressures encountered. U. S. Rubber Expansion Joints are the flexible connections that allow the pipes to give and take, to literally ride with the punch.

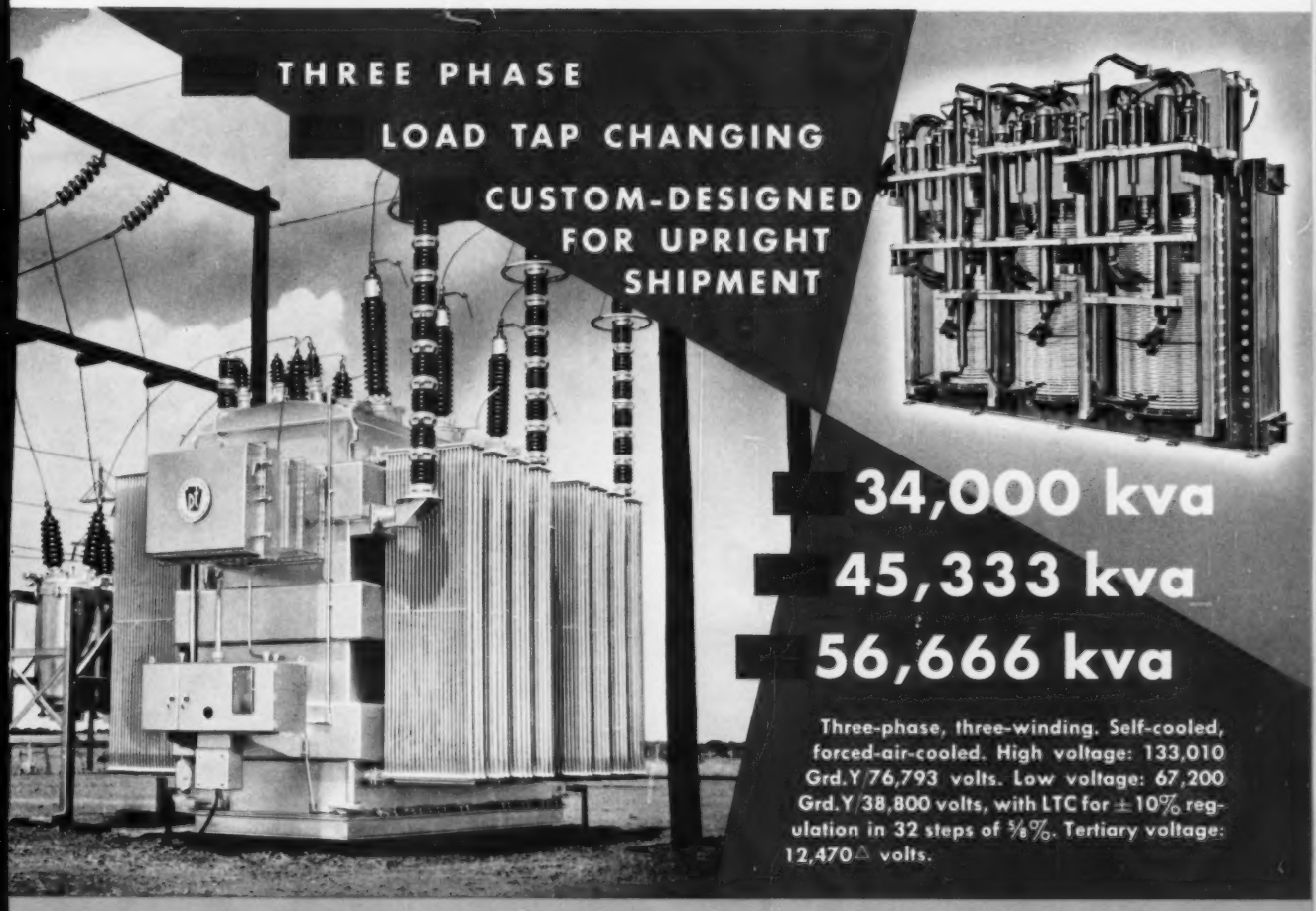
"These Expansion Joints were installed in 1940," says the plant superintendent, "and they've never given us trouble. We use them in sizes from as small as 6" all the way up to 48", and at water temperatures up to 170 degrees Fahrenheit. We know we will get many more years' wear out of them."

To absorb excess stresses due to expansion and contraction, to insulate against vibration, take care of misalignment, specify U. S. Expansion Joints. They are available at any of the 28 "U.S." District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y.

Mechanical Goods Division

United States Rubber

PENNSYLVANIA *Triple-rated* AUTOTRANSFORMER


THREE PHASE
LOAD TAP CHANGING
CUSTOM-DESIGNED
FOR UPRIGHT
SHIPMENT
34,000 kva
45,333 kva
56,666 kva
Three-phase, three-winding. Self-cooled, forced-air-cooled. High voltage: 133,010 Grd.Y/76,793 volts. Low voltage: 67,200 Grd.Y/38,800 volts, with LTC for ±10% regulation in 32 steps of ⅝%. Tertiary voltage: 12,470△ volts.

Shown here as it was placed into temporary service with only the self-cooled rating of 34,000 kva in operation, this Pennsylvania Autotransformer will achieve its forced-air ratings of 45,333 and 56,666 kva by means of fans mounted underneath the radiators. The transformer was shipped to its Southwestern installation site in an upright position, completely assembled except for detachable radiators and other external accessories.

The function of this three-winding, triple-rated, Pennsylvania Autotransformer is to transmit power from a 133-kv system to a 67-kv system. The load tap changer, which is located in the neutral end of the low voltage winding, maintains a constant low voltage during variations in the high voltage input. The tertiary winding (12.4 kv) is for stabilization of the neutral and for suppression of third harmonic voltages.

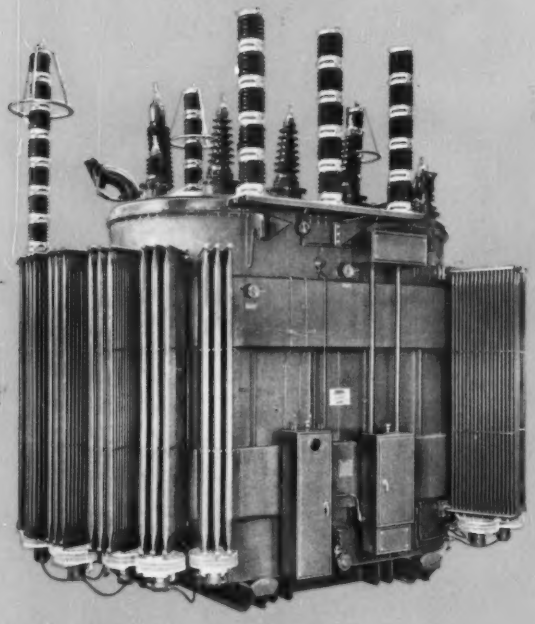
Pennsylvania Autotransformers are available in any kva and voltage size for:

- **INTERCONNECTION OF SYSTEMS**
- **PHASE SHIFTING**
- **GENERATING STEP-UP SERVICE**

Typical units on next 3 pages . . .

PENNSYLVANIA POWER TRANSFORMERS

PENNSYLVANIA



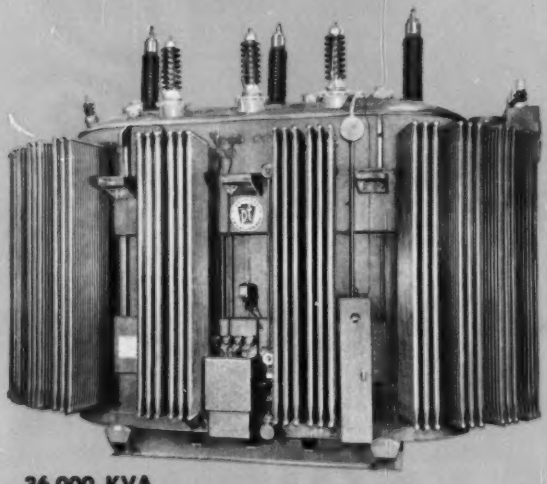
The range of applications and sizes of Pennsylvania Autotransformers is determined solely by the needs of America's power producers. Pennsylvania is equipped to handle the largest power transformer requirements contemplated today . . . and its experience in the field of autotransformers ranges from 525-kva, single-phase units, to the large, three-phase transformers shown on these pages. Autotransformers produced to date have included both two-winding and three-winding units . . . some of the latter with the tertiary loaded and others with the tertiary designed for suppression of harmonics only. Either core-form or shell-form design may be utilized, depending on requirements. Load tap changing equipment is optional.

Whether your next autotransformer must serve a special need such as phase shifting, or is for interconnecting systems . . . Pennsylvania has the facilities and the capability to meet your requirements. Contact Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

20,000/26,666/33,333 KVA

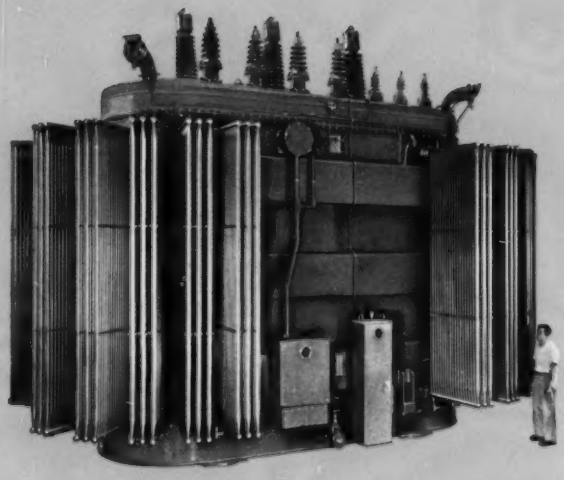
Three-phase, three-winding. Self-cooled, forced-air-cooled. High voltage: 132,000 Grd.Y volts. Low voltage: 66,000 Grd.Y volts. Tertiary voltage: 33,000Δ volts for loading.

WITHOUT LTC ←



36,000 KVA

Three-phase, three-winding. Self-cooled. Provisions for fans for 48,000/60,000 kva. Designed for both step-up and step-down service. High voltage: 136,800 Grd.Y/79,075 volts. Low voltage: 67,200 Grd.Y/38,800 volts. Tertiary voltage: 2400 volts for loading and suppression of harmonics.



60,000 KVA

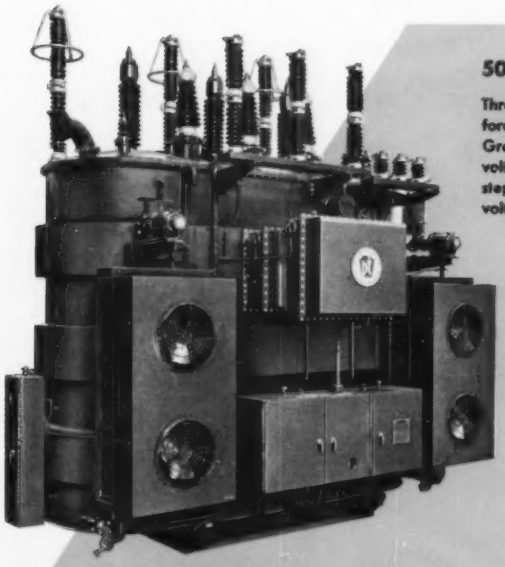
Three-phase, three-winding. Self-cooled. Provisions for fans for 75,000 kva. High voltage: 110,000Y/63,510 volts. Low voltage: 45,000Y/25,980 volts. Tertiary voltage: 13,200Δ volts for loading.

PENNSYLVANIA TRANSFORMERS

PENNSYLVANIA

AUTOTRANSFORMERS

Custom-Designed for Interconnection of Systems

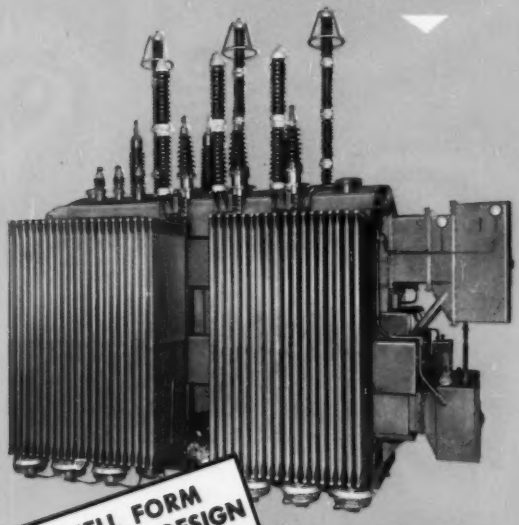


50,000 KVA

Three-phase, three-winding. Forced-oil, forced-air-cooled. High voltage: 132,000 Grd.Y volts. Low voltage: 69,500 Grd.Y volts with LTC for ±5% regulation in 32 steps of ⅝%. Tertiary voltage: 7200Δ volts for harmonic suppression.

60,000/80,000/100,000 KVA

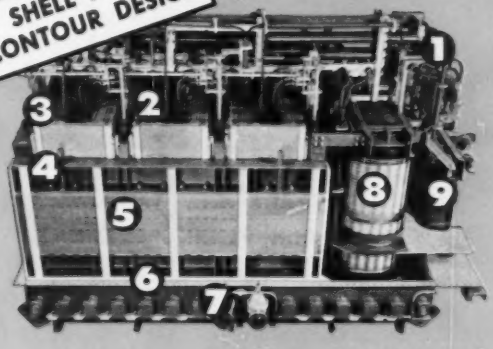
Shell form. Three-phase, three-winding. Self-cooled, forced-air-cooled, with forced-oil circulation for two higher ratings. High voltage: 132,000 Grd.Y volts. Low voltage: 69,300 Grd.Y volts, with LTC for ±10% regulation in 32 steps of ⅝%. Tertiary voltage: 13,200Δ for harmonic suppression.

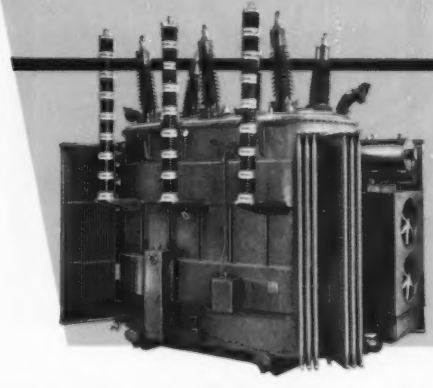


➡ WITH LTC

1. Tap leads for load tap changing equipment supported in insulating tubing between coils and LTC panel.
2. Vertical cooling ducts in coils permit free flow of oil through coils.
3. Sturdy, fabricated box sections of core frame securely clamp coils to protect against mechanical forces during short circuits.
4. Core and coils clamped together with fabricated steel members. Core-and-coil unit can be handled separately as complete assembly.
5. Core cooled by both vertical and horizontal ducts.
6. Core-and-coil assembly rests on flange of bottom section of tank.
7. Oil enters common header after passing through radiators, and is recirculated by pumps for 80,000- and 100,000-kva ratings.
8. Series transformer in low voltage line.
9. Preventive autotransformer maintains a continuous circuit during load tap changing operation.

SHELL FORM CONTOUR DESIGN





PENNSYLVANIA Phase Shifting AUTOTRANSFORMER

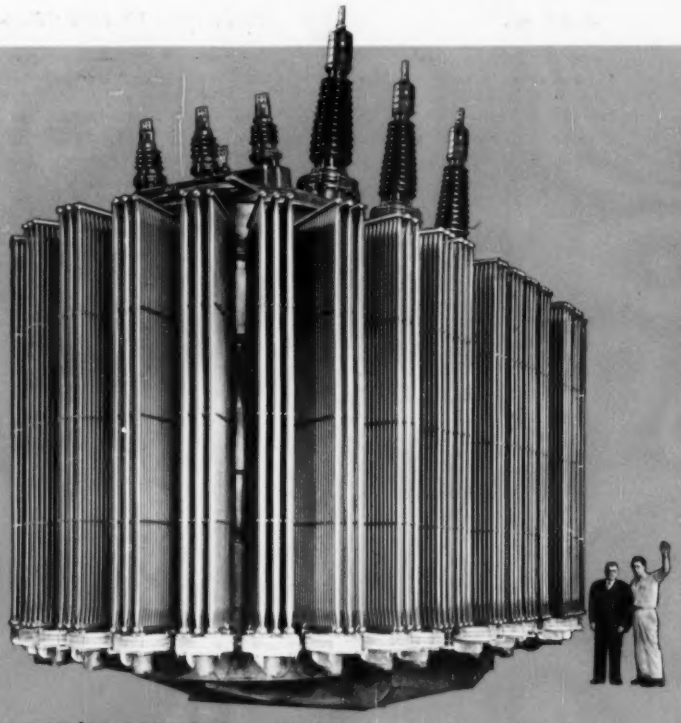
45,000/60,000/70,000 KVA

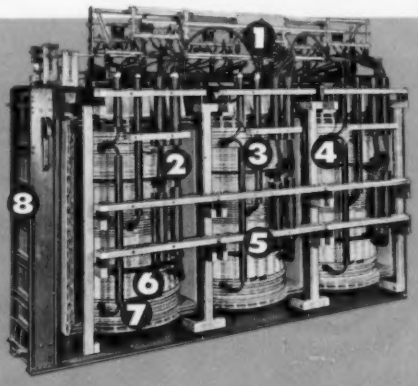
Three-phase, two-winding. Self-cooled, forced-oil-cooled with forced-air heat exchangers. Designed to provide 30° phase shift in 115-kv line. High voltage: 115,000Δ volts. Low voltage: 115,000Δ volts.

POWER TRANSFORMERS

PENNSYLVANIA *Dual Step-up* AUTOTRANSFORMER

...designed for Main Step-up Generating Station Service





1 Tap changer located above core and coils for easy access through cover of transformer.

2 Two sets of taps per coil assure excellent electrical and mechanical balance in windings.

3 All leads well supported and insulated in heavy pressboard tubes.

4 Continuous pancake winding in high and low voltage coils. Helical winding in tertiary coils.

5 Taps located in high voltage windings as well as low voltage windings.

6 Coils are precompressed and secured to prevent mechanical distortion under short circuit stress.

7 Extra heavy insulation at line ends of coils. Graded insulation at ground ends of coils.

8 Five-legged core reduces shipping height.

48,000/60,000 KVA

Three-phase, three-winding. Self-cooled, forced-air cooled. High voltage: 132,000 Grd. Y volts. Low voltage: 67,200 Grd. Y volts. Tertiary voltage: 13,200Δ volts.

This three-winding autotransformer has a self-cooled rating of 48,000 kva and a forced-air-cooled rating of 60,000 kva. Specially designed for "dual step-up" service, it takes the full capacity of the generator on the 13,200-volt delta tertiary winding and steps up the voltage to either 132,000 volts or 67,200 volts, or to both simultaneously. If the generator is out of service, the transformer permits full capacity transfer between the 132,000-volt and 67,200-volt systems through the auto connection in the high voltage winding.

Pennsylvania is experienced in the design and manufacture of autotransformers in all kva and voltage sizes and for any purpose: interconnection of systems, phase shifting, as well as generating station step-up service. Transformers are available with or without load tap changing. Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pennsylvania.

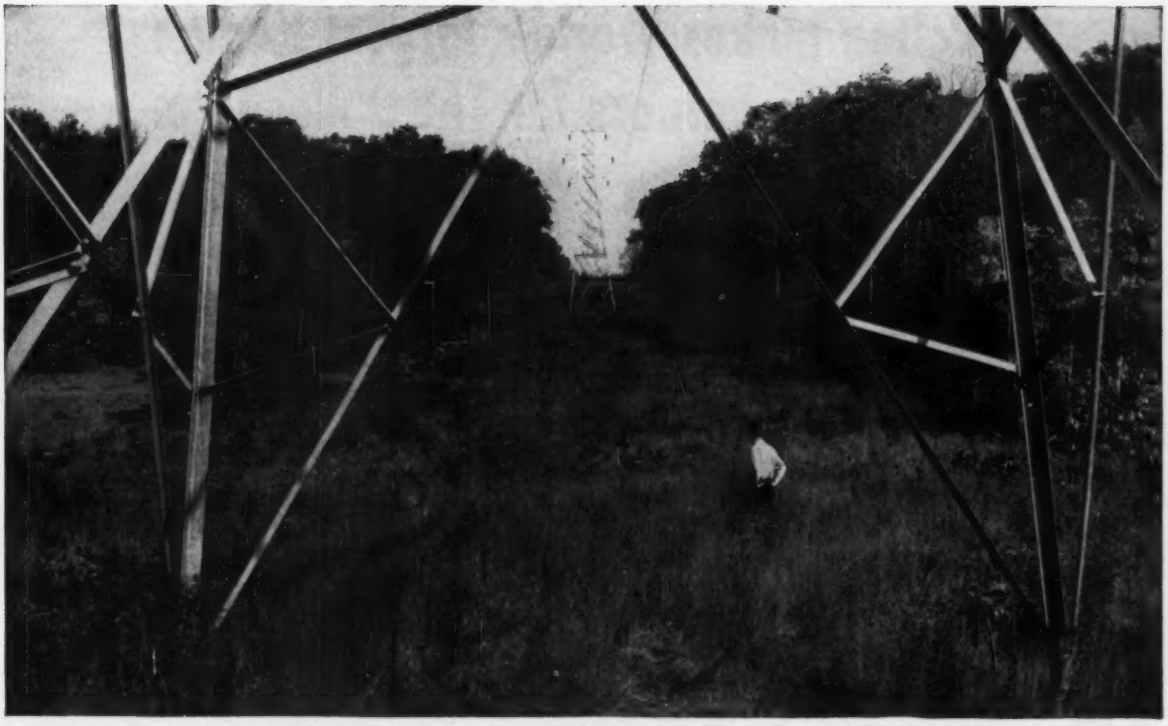
Pennsylvania has the facilities and the capability to meet all Power Transformer Requirements . . . . . .

- A large, expertly-staffed engineering department with long experience in power transformer design — both core form and shell form.
- The ability to design and construct full-scale test models for proving design characteristics.
- A modernly equipped plant capable of producing and testing the highest rated units contemplated by industry today.
- Handling and loading facilities that permit full utilization of manufacturing, shipping and installation economies.

See preceding 3 pages for other Pennsylvania Autotransformers

PENNSYLVANIA POWER TRANSFORMERS

5703



• Brush control with "Ammate" three growing seasons after application! This Rockland Power and Light right of way was originally 100% brush. Photograph taken October 1956.

Why it pays to control brush with Du Pont AMMATE® X

WEED AND BRUSH KILLER

"Ammate" X is not volatile! . . . You can use "Ammate" on rights of way, even when they adjoin cropland planted to sensitive crops like cotton, soybeans, tobacco and peanuts.

"Ammate" X assures lower-cost, longer-term brush control . . . When the original spray job is done well, only occasional spot sprays are required to keep brush under control for years.

"Ammate" X kills roots of brush as well as tops . . . yet allows low-growing natural cover to come back.

"Ammate" X as a foliage spray . . . Kills more kind of brush and keeps it down longer than any other known herbicide.

"Ammate" X is easy to use . . . can be used without hazard to applicators, livestock or wildlife, as well as to nearby crops.

Earl Tomes, Manager
Taylor County REA
Campbellsville, Ky.
says:

"We have been using 'Ammate' for five years. We have found it to give the best kill of all type chemicals we have used. Another reason we use this chemical is due to the fact that in our area we have so much tobacco and so many tobacco beds that during the spraying season we can hardly use any other type. In our five years of using 'Ammate' we have not had a single off the right-of-way complaint or claim for damages."

WHERE WEEDS AND GRASS ARE A PROBLEM, you can rely on Du Pont "Telvar" weed killers for season-long control. Use "Telvar" around substations, pole yards and other areas where maintenance is tough and costly. Low dosages do the job. "Telvar" weed killers are wettable powders, are non-flammable, non-volatile, non-corrosive and low in toxic hazard.

On all chemicals follow label instructions and warnings carefully.

DU PONT

REG. U. S. PAT. OFF.

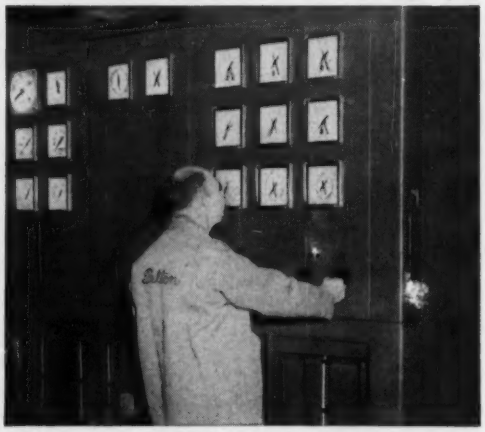
BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

Pelton makes world's largest Kaplan turbine governors for The Dalles Dam

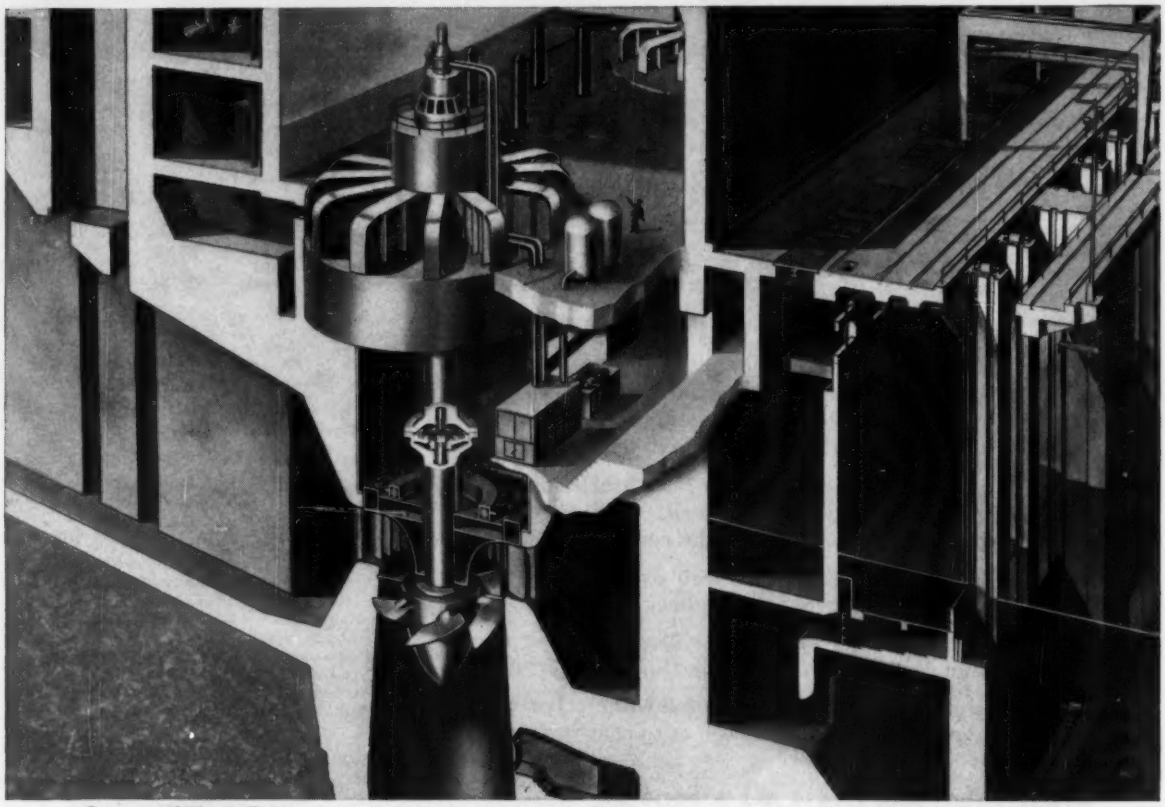
Of the 16 Kaplan turbine governors which Baldwin-Lima-Hamilton's Pelton Division is supplying for The Dalles Dam, located on the Columbia River, 14 are the largest ever built. Each has a wicketgate capacity of 950,000 ft.-lb. and a Kaplan blade capacity of 720,000 ft.-lb. In order to be absolutely certain that they will meet contract specifications in every respect, Pelton exhaustively tests these governors under simulated power plant conditions prior to installation.

In addition to governors, B-L-H is furnishing The Dalles Dam with 14 Kaplan type turbines, each rated to deliver 123,800 hp at 85.7 rpm under 81-ft. head. Station service units are also being produced for this project by B-L-H's Pelton Division. The Dalles Dam is thus a superb testimonial to Baldwin-Lima-Hamilton leadership in the design and manufacture of hydraulic turbines and related equipment.

For a copy of our newest illustrated bulletin, write B-L-H Corporation, Philadelphia 42, Pa., or Pelton Division (B-L-H), 2929 Nineteenth Street, San Francisco 10, Calif.



An inspection of one of the 16 Kaplan turbine governors for The Dalles Dam is made at B-L-H's Pelton Division.



Cutaway of The Dalles Dam powerhouse, where 16 Kaplan turbine governors built by Baldwin-Lima-Hamilton's Pelton Division and 14 Kaplan turbines built by the Eddystone Division of B-L-H are being installed. Artist's rendition courtesy of Portland District, Corps of Engineers, U.S. Army.

Pelton Division San Francisco, Calif.

BALDWIN · LIMA · HAMILTON

Hydraulic turbines • Valves • Governors • Centrifugal pumps

KUHLMAN "Salesman of the Week" If you can identify this Kuhlman representative, and are the first one to notify Dept. SA-1, Kuhlman Electric Co., Bay City, Mich., you will receive a valuable gift.

"TAKE A LOOK AT THIS DISPLAY OF KUHLMAN DISTRIBUTION TRANSFORMERS...

. . . It will give you some idea of the many design variations Kuhlman offers. Conventional . . . CSP . . . REA . . . Subway . . . Banked (CSPB)—whatever your transformer needs are, Kuhlman has just the right unit for the job.

"Each design is light, compact and easy to interchange as your load grows. Most feature "Quick-Grip" insulated high voltage bushings for ratings above as well as below 5 KV. In the CSP line you have a choice of either expulsion or valve type arresters. And for special requirements you can order: over-load signal lights for conventional transformers . . . oversized bushings for increased creepage and high altitudes . . . discharge gaps for ungrounded tanks . . . porcelain finish for corrosive atmospheres . . . and many others.

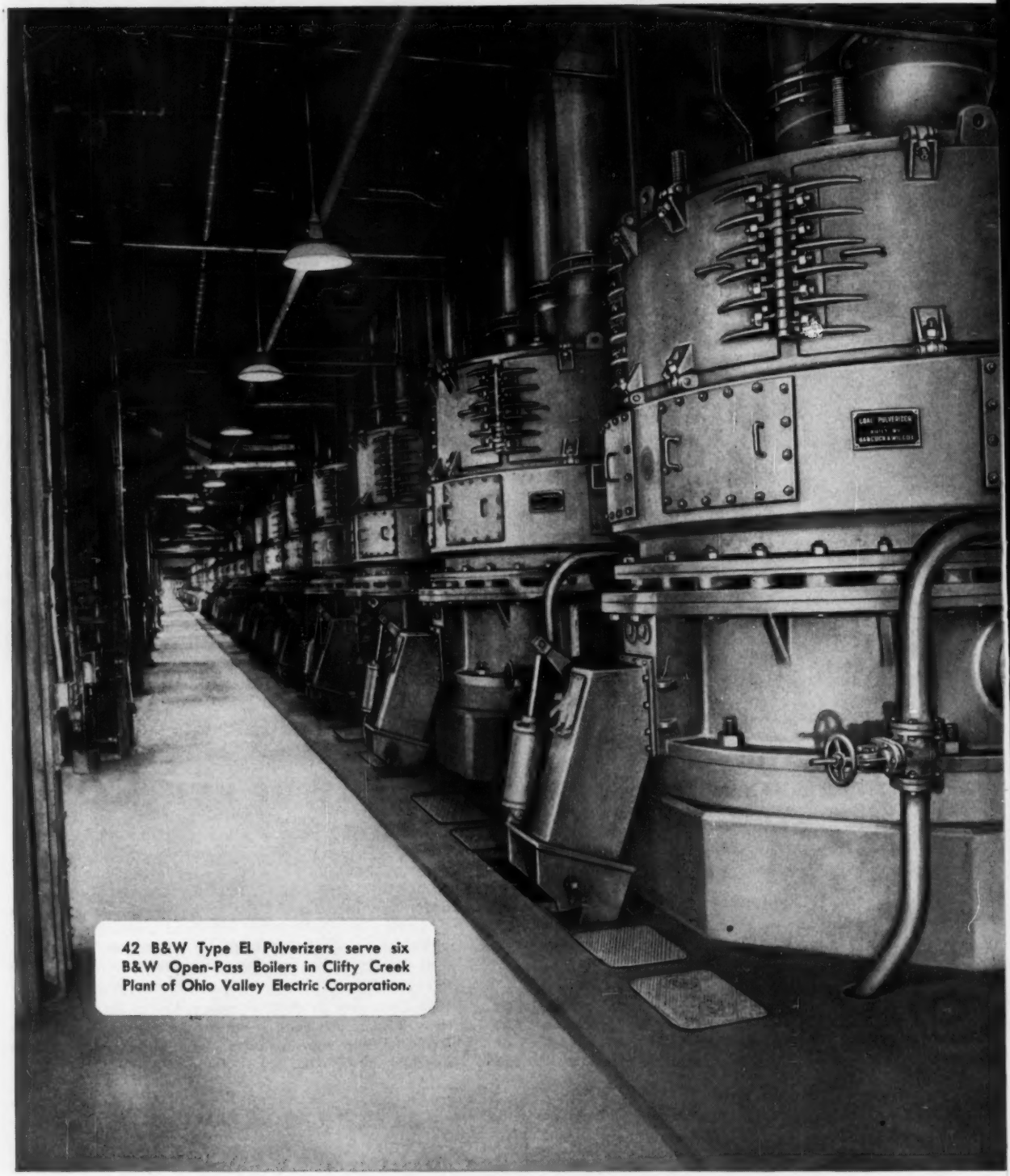
"I've been able to illustrate only a few of the possibilities here. If what you need is not here, get in touch with your local Kuhlman representative. He'll give you the whole Kuhlman story."

KUHLMAN ELECTRIC COMPANY

5712a

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA

Have You Investigated
THE MODERN B&W



42 B&W Type EL Pulverizers serve six B&W Open-Pass Boilers in Clifty Creek Plant of Ohio Valley Electric Corporation.

DIRECT-FIRING SYSTEM?

A Compact, Space-Saving Package of Efficient Grinding Power

More power and capacity in a compact arrangement . . . long-range dependability . . . reduced operating cost — these are the measurable results of continuous, intensive development of the modern B&W Pulverizer. It has established an outstanding production and efficiency record in thousands of commercial installations. Here are some reasons why:

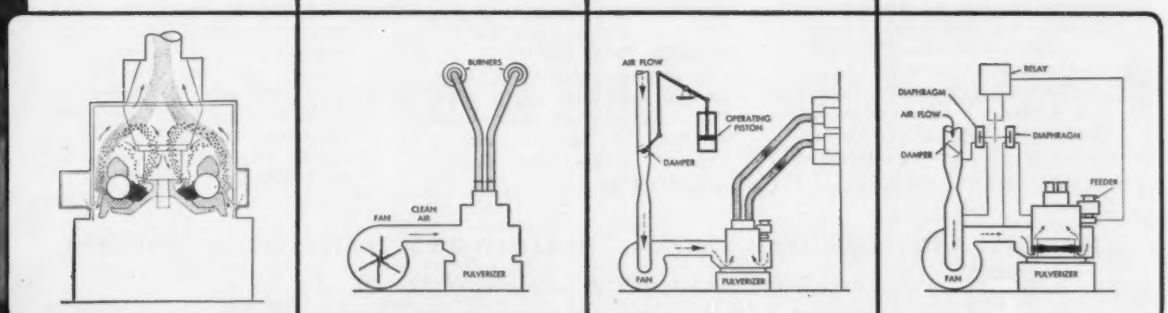
Continuous High Fineness Over Entire Service Life: Efficient combustion requires high fineness at all times. The high circulating load of the B&W Pulverizer permits efficient and dependable classification of product, so that only material of proper fineness leaves the unit. In addition, its slow-speed, spring-loaded ball bearing grinding elements maintain proper grinding contact throughout their service life.

Handles Wide Variety of Low Grade and Wet Coal: Regardless of the coal's grade or whether it's dry or soaking wet, the B&W Pulverizer's unique and exclusive recirculation of fuel through heated air assures efficient grinding . . . eliminates shutdown, capacity loss, or special attention from operators.

Simplicity of Arrangement and Reduced Maintenance: Accessibility for all normal maintenance makes it simple, quick, safe and low-cost. Adjustments are easily made while the unit is in operation. Using only clean primary air supplied under pressure, fan maintenance is substantially reduced and fuel piping is greatly simplified. Also, with the pulverizer acting as its own distributor, no special distributing devices are needed. Grinding elements are of special alloy material. They last two years or more on eastern coals and at least a year on midwestern coals.

Adaptable to All Types of Automatic Controls: Because it features "one point contact with the boiler," operation of the B&W Pulverizer is simple. The boiler's automatic combustion control is connected to the pulverizer at only one point—the damper in the primary-air duct. The pulverizer's own control system regulates all other functions, such as maintenance of proper fuel-air ratio and operating temperature.

SEND FOR DATA. For full information about the B&W Type EL Pulverizer and Pulverized-Fuel Firing Systems, write: The Babcock & Wilcox Company, 161 E. 42nd Street, New York 17, N. Y.



COAL RECIRCULATION — this means high fineness, aids drying.

PRESSURE SYSTEM — this eliminates fan wear, simplifies piping.

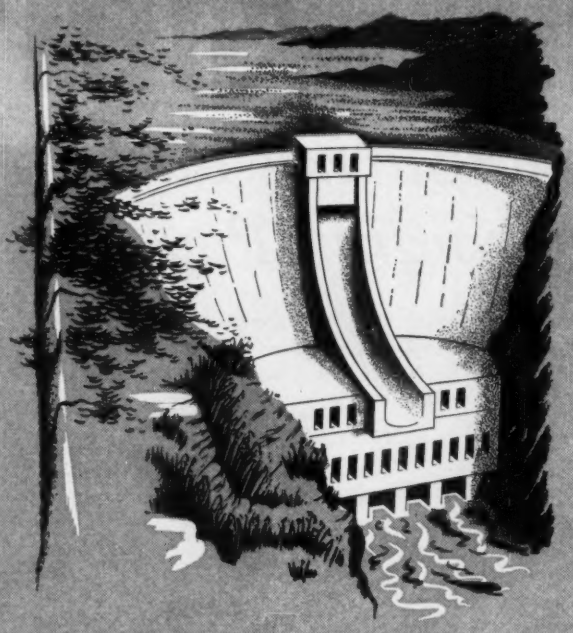
AIR CONTROL—this means one, simple control contact point.

MILL LEVEL CONTROL — this automatically adjusts fuel-feed.

BABCOCK & WILCOX

BOILER DIVISION

G-766



FERRANTI

Transformers for Hydro-Electric Schemes

As specialists in the manufacture of transformers for more than 65 years, FERRANTI LTD. have been associated with many of the world's largest hydro-electric schemes. More recent achievements include contracts for over 4,000,000 kVA of large high voltage power transformers, among which are:—

CENTRAL AFRICA

Two 120,000 kVA and ten 60,000 kVA 330,000 volts three-phase Transformers have been ordered by the Central African Federation Power Board for the Kariba Hydro Electric Scheme. This is the largest overseas transformer contract ever to be placed in the United Kingdom.

CANADA

Seven 71,000 kVA, 301,400 volt single-phase Ferranti generator transformers and six 37,000 kVA, 275,000 volt step-down Ferranti transformers have been ordered by the Aluminum Company of Canada Ltd. for the Alcan Project at Kemano and Kitimat, British Columbia. Four of the generator transformers and all of the supply transformers are now in commission.

U.S.A.

GARRISON DAM PROJECT Nine 33,333 kVA, 230,000 volt single-phase Ferranti transformers forming three 100,000 kVA banks have been supplied to the U.S. Army Corps of Engineers for the Garrison Dam Project, North Dakota.

McNARY DAM PROJECT Six 56,000 kVA, 230,000 volt, single-phase transformers have been ordered by the U.S. Army Corps of Engineers for the McNary Dam Project, Oregon.

DALLES DAM PROJECT The contract covers eighteen 63,000 kVA, 230 kV and three 63,000 kVA, 115 kV, single-phase transformers for the U.S. Army Corps of Engineers Dalles Dam Project, Columbia River.

NEW ZEALAND

Twenty-six Ferranti large power transformers have been ordered by the State Hydro-Electric Department of New Zealand. Thirteen 14,800 kVA, single-phase, 50 cycles, 11/220 kV transformers have been supplied to Roxburgh, and thirteen 9,259 kVA, single-phase, 50 cycles, 11/220 kV transformers have been supplied to Whakamaru.

INDIA

Three Ferranti 20,000 kVA, OFB, 3-phase, 50 cycles, 132/33-66 kV transformers with on-load tap changing gear and two Ferranti 10,000 kVA, ON/OB, 3-phase, 50 cycles, 132/33 kV transformers with on-load tap changing gear have been supplied for the Damodar Valley Power Scheme in India.

FERRANTI LTD., Head Office and Plant: HOLLINWOOD · LANCASHIRE · ENGLAND

London Office: KERN HOUSE · 36 KINGSWAY · W.C.2

NEW YORK: Ferranti Electric Inc., 30 Rockefeller Plaza, N.Y.20

TORONTO: Ferranti Electric Ltd., Mount Dennis, Toronto 15, Ontario

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GEM MILL: Chadderton, Lancs., England.
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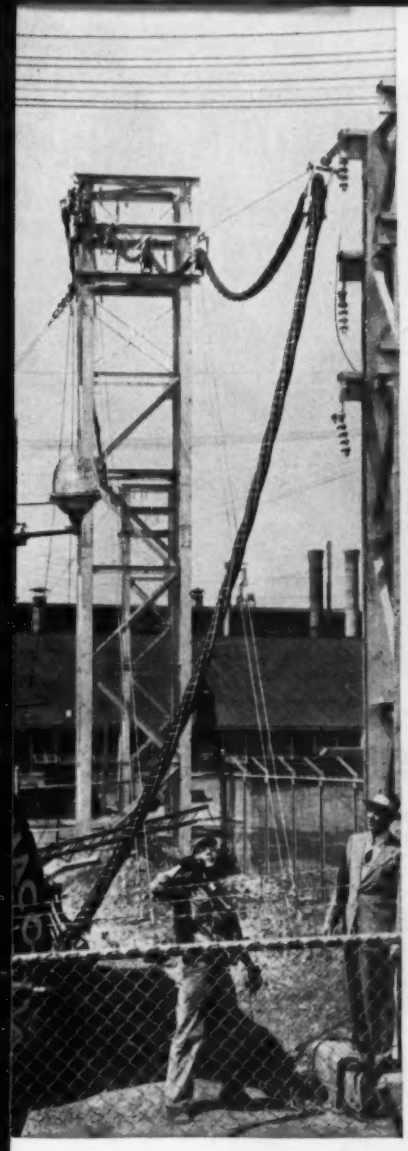
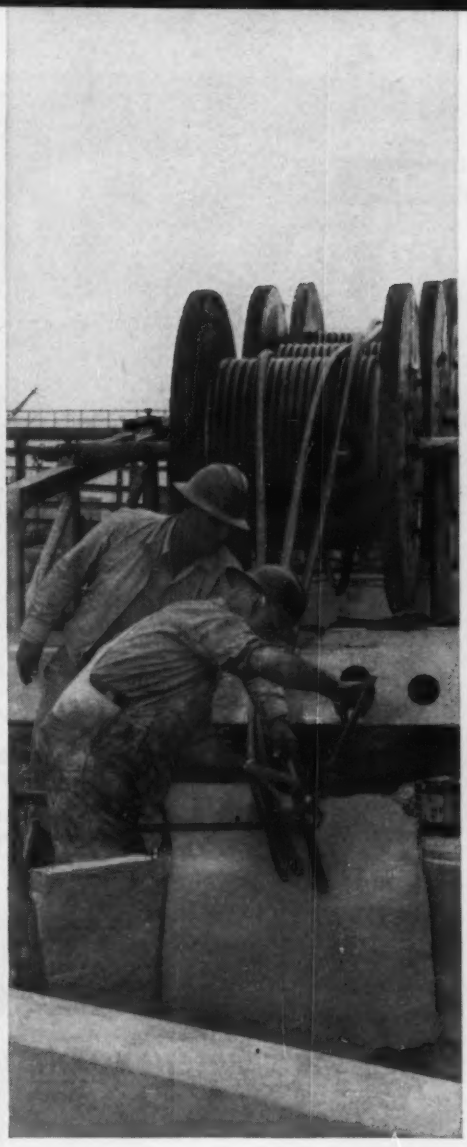




Overhead . . . in ducts . . . underground

Order one cable for all three jobs . . . Anaconda Durasheath

Overhead . . . in ducts . . . underground. Use Durasheath* neoprene-jacketed cable for every type of power application up to 15 kv. Tough jacket resists weather, soil acids, abrasion, mechanical injury.

One continuous run without splices. Run Durasheath from underground, to overhead, to ducts, *in one length* without splicing. Light, flexible, it handles easily. Costs less to install.

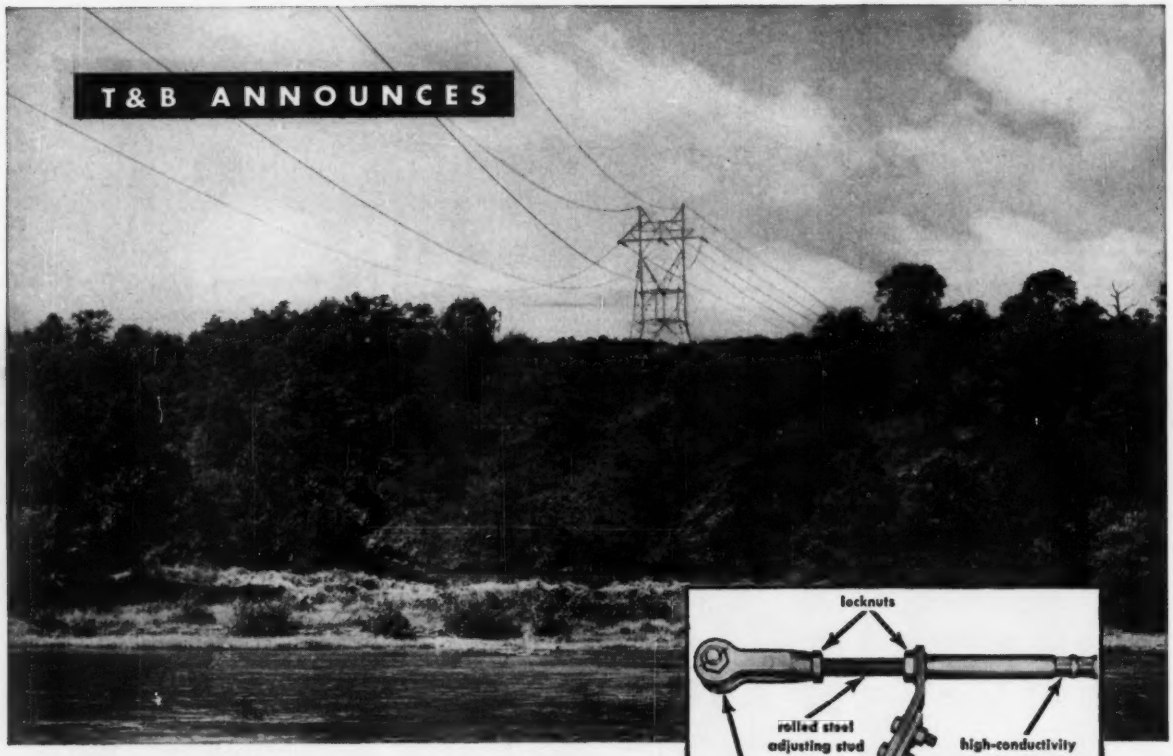
Stock one cable instead of three. You save space, paperwork with all-purpose Durasheath. One cable does the work of three. You cut inventory. Versatile Durasheath excels everywhere.

See the Man from Anaconda or your Anaconda distributor for full information. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

*Trade Mark 57361

ASK THE MAN FROM ANACONDA®

FOR DURASHEATH CABLE



a new concept in transmission dead ending!

DEAD END CONNECTORS PERMIT SAG CORRECTION AFTER JOINT IS COMPLETED

Now you can adjust conductor sag to specification after the strain connection has been made! Four inches of clevis adjustment available provides great sag adjustment. For example: in a 700 foot span of 795,000 CM A.C.S.R. sagged at 50% of ultimate strength, the 4 inch clevis adjustment will allow 4 feet of sag adjustment.

The new dead end connector gives many important advantages; transmission line dead ending at river crossing and over rough terrain is simplified, more economical; "bundled" cables can be easily sagged with complete uniformity; line measurement errors can be readily compensated.

T&B Dead Ends are available for all commercial sizes of A.C.S.R. and all-aluminum conductors in three types: single bolting pad, double bolting pad, and with an integral compression loop connection.

For complete specifications on the new dead ends, as well as the complete new catalog of T&B Method transmission line connectors, tools and accessories, send the coupon below.

AUTHORIZED DISTRIBUTOR T&B ENGINEERED

LOOK FOR THIS SIGN — IT'S THE MARK OF AN AUTHORIZED DISTRIBUTOR

THE THOMAS & BETTS CO. INCORPORATED

14 BUTLER STREET, ELIZABETH 1, NEW JERSEY

Please send me the new T&B Method Bulletin 70

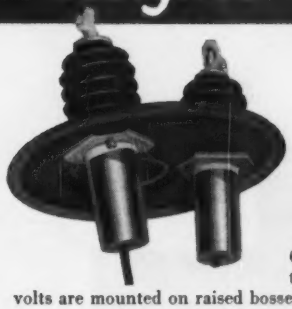
Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

Wagner Form W Pole-Type Transformers
designed for modern distribution systems



HIGH VOLTAGE BUSHINGS

Cover mounted bushings on transformers above 5000 volts are mounted on raised bosses to provide a perfect gasket seat—water drains off quickly.

SHUR SEAL COVER CLAMP

The spring action of the tank lip and Shur Seal clamping ring keeps gasket under uniform pressure to seal transformer air-tight. Cover is easily removed—only one bolt to loosen.

DOUBLE LOCKED LOW VOLTAGE BUSHINGS

Porcelain is key-locked to tank wall, terminal is key-locked in porcelain to prevent turning when connections are made. No loose connections—no internal short circuits.

SAFETY H.V. SIDEWALL BUSHINGS

Sidewall high voltage bushings on transformers below 5000 volts are also double locked. Chuck type terminal with insulated hand knob permits safe, easy connections without the use of tools.

Only Wagner offers all these important features...PLUS

TERMINALS
Suitable for use with either copper or aluminum conductor.

DOMED COVER
Provided with big enough hand hole to get to the tap changer easily.

STEEL TANK
Light, strong, seam welded sheet steel tanks have recessed tank bottoms.

DURABLE FINISH
All tank surfaces are sand-blasted and given three coats of individually baked-on paint.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

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ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS • AIR AND HYDRAULIC

There IS a Difference!

Connectors may look alike but it's PERFORMANCE that counts

BLACKBURN CONNECTORS OUT-PERFORM THEM ALL

Because They Are . . .

BETTER MECHANICALLY

- Made of high strength duronze, a silicon bronze alloy stronger than structural steel.
- Machine cut threads, *CFC treated, provides more thread engagement —reduces friction and increases thread efficiency. *Chemical Friction Control.
- Rigid inspection of each production operation assures uniformly good connectors.

BETTER ELECTRICALLY

- High clamping force—the result of greater thread efficiency breaks down oxide on the conductor improving conductivity.
- Higher initial conductivity, actually greater than an equal length of conductor is maintained permanently.

REUSABLE

- Selection of proper high-strength, corrosion-resistant materials—plus precision workmanship and inspection—means Blackburn connectors may be used over and over.

BLACKBURN *Hi-Strength* CONNECTORS

AVAILABLE AT ELECTRICAL WHOLESALERS EVERYWHERE

JASPER BLACKBURN CORP., 35 Madison Street, St. Louis 6, Missouri • Phone MAin 1-2821

PROPER CIRCUIT EQUIPMENT is a "must" for any well-lighted street, and the full line manufactured by G.E. meets all system requirements.

Reliable, job-matched control equipment backs every General Electric street lighting system

In the over-all solution to your street lighting problems, the matter of proper control and protection is a major consideration. And General Electric is prepared to meet your exact needs with a full line of modern, dependable, efficient circuit equipment.

Selection of control equipment depends on such factors as type of light source, use of series or multiple circuits, whether overhead or underground wiring is available, etc. For each combination of these and many other factors, General Electric engineers have both the equipment and experience to develop control systems exactly suited to your job.

And because General Electric is a full-line street lighting manufacturer—not restricted to one type of system—the advice you get will be impartial—based on engineering and economic facts!

VISION-ENGINEERED SYSTEMS

Let G.E. help your street lighting program on a ***vision-engineered system*** basis. On every lighting project, regardless of type or size, General Electric offers you:

PROJECT RESPONSIBILITY—one source of supply for ***all*** your street lighting needs. This includes complete lines of filament, mercury, and fluorescent luminaires as well as control equipment.

COMPLETE ENGINEERING ASSISTANCE—expert start-to-finish aid from field and factory lighting specialists.

RESEARCH LEADERSHIP—the industry's newest and most complete laboratory, development, and proving facilities are located at General Electric's "Outdoor Lighting Center of the World" in Hendersonville, N. C.

Get the full ***vision-engineered system*** story from your nearest Apparatus Sales Office or authorized agent! General Electric Co., Schenectady, N. Y.

LIVE BETTER ELECTRICALLY

452-168

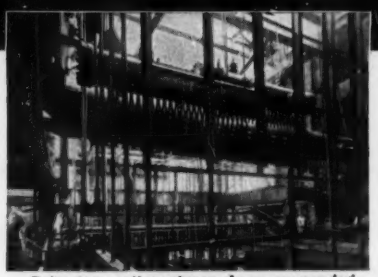
VISION-ENGINEERED STREET LIGHTING SYSTEMS

GENERAL ELECTRIC

Progress Report

2,000,000 lb/hr

View looking upward in the reheater section, showing the 126-ton steam drum being raised into position. Shipped completely fabricated from Foster Wheeler's Mountaintop, Pa., plant, the first of the two steam drums arrived on the job-site on May 28, 1956 and was raised into position on June 1st.



Reheater section steam drum suspended in approximate position for final location, viewed from upper level.

Reheater section showing steam drum, headers and hangers in place, looking upward from 7th floor level.

on World's First

STEAM GENERATOR

Record-shattering FW steam generator for Detroit Edison's River Rouge Plant will deliver 8,620 btu per kwhr for 320,000 kw Unit No. 3

THE first steam generator ever designed to produce 2,000,000 pounds of steam per hour is now well under construction at Detroit Edison's River Rouge Plant. This huge FW steam generator, for 320,000 kw Unit No. 3, will also be one of the most efficient and economical units ever built. With a heat rate of 8,620 btu per kwhr, it will produce a kilowatt of electricity from less than ¾ lb of coal!

Designed for a pressure of 2700 psi, with 2450 psi and 1050F at the superheater outlet, it includes reheat facilities for resuperheating the steam to 1000F after it has passed through the initial stages of the turbine.

This single-unit FW steam generator consists of two separate sections, each containing a radiant superheater. All of the convection superheater surface is located in the "superheater section" and all of the convection reheater surface, in the "reheater section." Firing of the reheater section furnace is controlled to maintain 1000F reheat steam temperature, while the superheater section furnace is fired to maintain primary steam pressure. Primary steam temperature of 1050F is controlled by condenser-type desuperheaters.

The photographs included here show progress in the erection of this history-making FW steam generator at the River Rouge plant. This outstanding installation is another example of Foster Wheeler's ability to meet the most exacting requirements of modern power plant operation. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

FOSTER WHEELER

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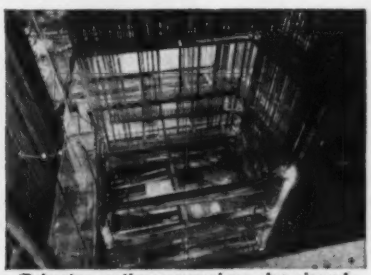
View of economizer space of the superheater section, looking downward from the 9th floor level.



Reheater section economizer, also viewed from 9th floor elevation during construction.

Foster Wheeler's Construction Superintendent H. A. Shouse and Field Materials Coordinator A. K. Broome inspect radiant wall tiebacks.

the O.Z. SHURELUG

has more of the features you want...

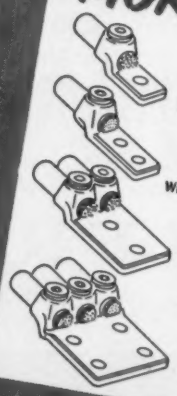
O.Z. means more for you

The O. Z. ShureLug is the newest addition to the complete O. Z. line of electrical fittings; more proof of O. Z.'s policy to make available dependable products at realistic prices.

MORE SIZES

The new O. Z. ShureLug is available for a wide range of sizes, including "in between" sizes usually found only in more expensive makes. This means that whether the job calls for #14 sol. or 1000 MCM cable, there will be an O. Z. ShureLug that will meet your needs more closely, more exactly, for a more secure, more dependable connection.

MORE MODELS



Here's variety too!: O. Z. ShureLug is available in single barrel, double barrel, and triple barrel models . . . with socket heads or hex heads . . . in single hole, double hole, and four hole styles, depending upon sizes selected. Here again, premium selection at practical prices!

MORE ECONOMY

O. Z. ShureLugs are priced no higher than other competitive brands, but you get so much more! Because O. Z. ShureLug is made in more sizes, more models, you buy only the capacity you actually need . . . only the capacity that you'll actually use. Why spend more for over-sized lugs when O. Z. has the size you want, the model you need, at the low economical prices you want to pay?

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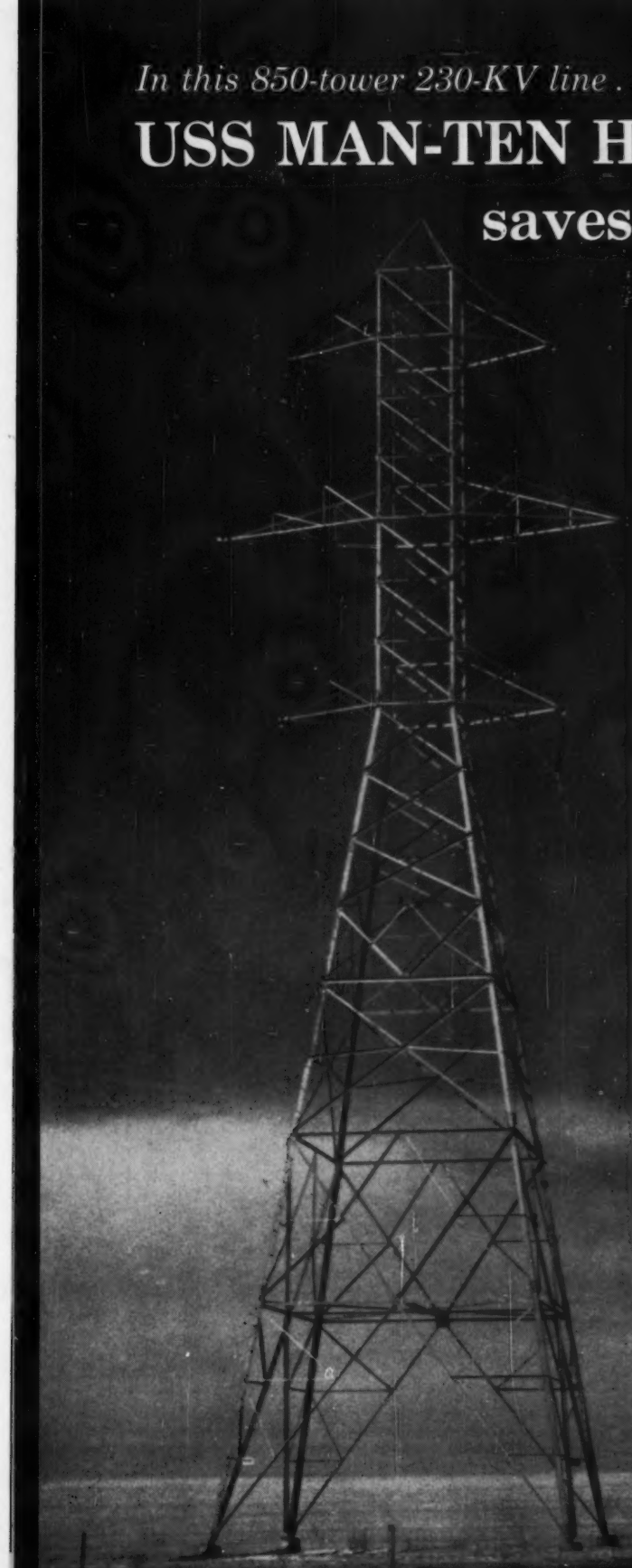
In this 850-tower 230-KV line . . .

USS MAN-TEN High Strength Steel saves 1000 lbs. per tower



BY THE SELECTIVE USE of USS MAN-TEN Steel, a total of 425 tons of steel was saved in this 205-mile double circuit line—a substantial weight reduction that paid off handsomely.

For by cutting one-half ton of weight off each transmission tower, the initial cost of the structures was reduced. In addition, with 425 tons less to move, the cost of transportation was cut, erection was faster and easier.

Weight is an important factor in determining transmission tower costs, particularly when the line runs through rough, hard-to-reach country or where much off-road hauling is involved. Every pound of weight saved means money saved.

That's why it will pay you to investigate the advantages that weight-saving construction with USS MAN-TEN Steel offers you.

USS MAN-TEN Steel has a yield point 50% higher than structural carbon steel—yet it costs very little more. Its higher strength makes it possible to reduce the thickness—and the weight—of tower legs, cross arms and bracing members without any sacrifice in strength and durability. Its low cost makes such weight reduction both practical and economical.

You will find our 174-page "Design Manual for High Strength Steels" extremely useful in applying USS MAN-TEN and our other famous high strength steels, USS COR-TEN and USS TRI-TEN "E," to your designs. For your free copy, write—on your company letterhead—to United States Steel, Room 2801, 525 William Penn Place, Pittsburgh 30, Pa.

This Bureau of Reclamation line runs from Big Bend, South Dakota, 205 miles northeast to Granite Falls, Minnesota. Towers were fabricated by American Bridge Division, United States Steel.

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AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
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TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
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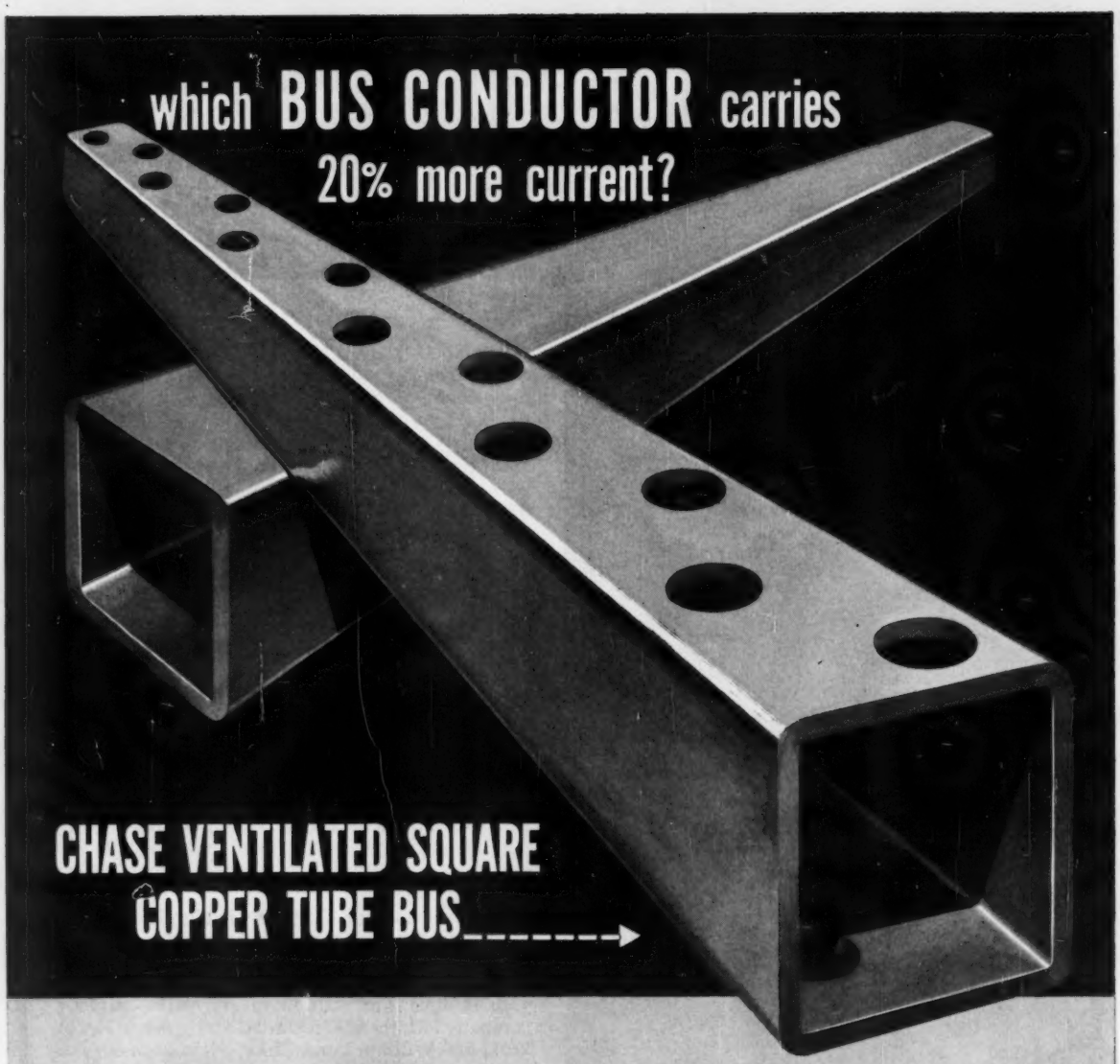
UNITED STATES STEEL — USS HIGH STRENGTH STEELS — 1933 1957 — 24 YEARS OF PERFORMANCE

which BUS CONDUCTOR carries 20% more current?



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Twenty per cent more current just naturally flows through Chase ventilated square bus! Convection-cooling reduces operating temperatures so conductivity is kept at a maximum—twenty per cent higher current than ordinary unventilated bus! Chase square bus is tops in structural rigidity and ease of jointing, too. Full information about this heavyweight champ and other Chase buses is yours, FREE. Send for Chase's bus conductor booklet.

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CHASE ELECTRICAL CONDUCTORS
are available in a variety of shapes to suit every power-carrying need.

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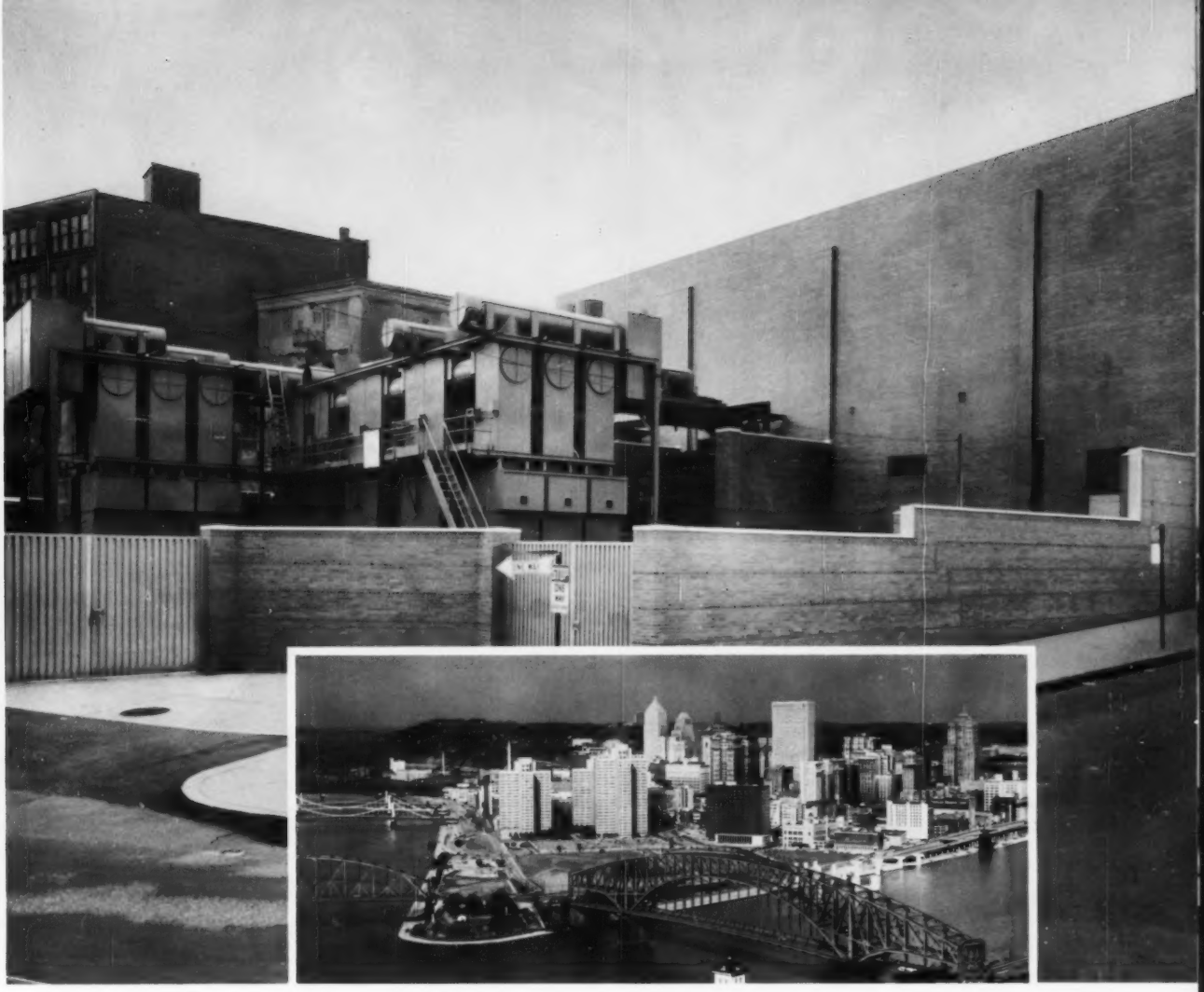


FORBES SUB-STATION

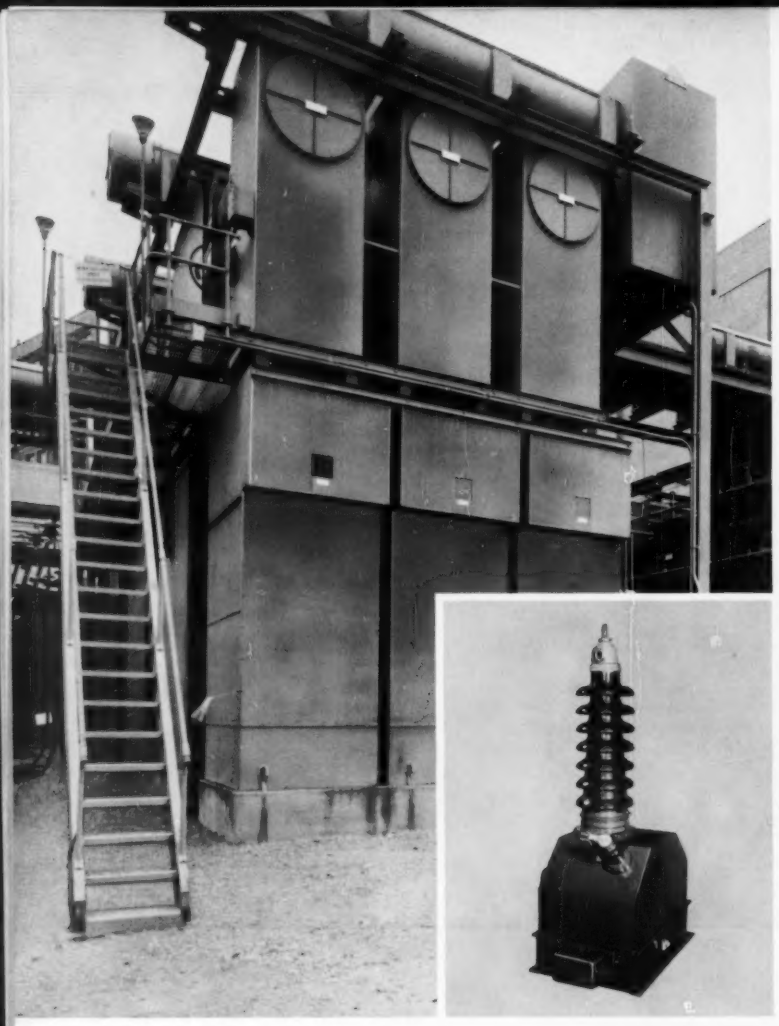
Sub for Pittsburgh's new sky line occupies one-fifth normal space

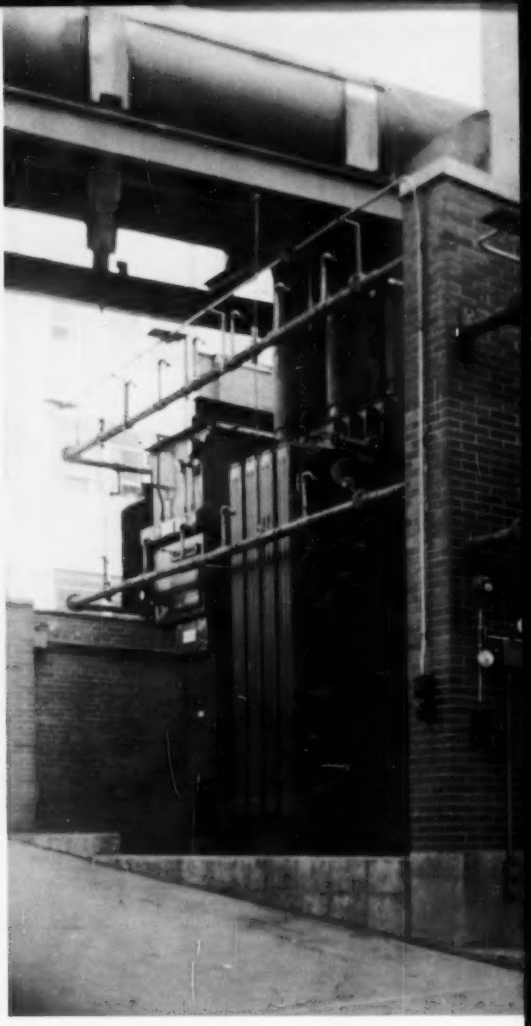
The dramatic reshaping of a new sky line in Pittsburgh has attracted national attention. But the utility industry has focused on the ingenuity exercised by Duquesne Light Company in bringing 69-kv power directly into such a congested, high-value area.

Duquesne's engineering department first conceived the idea when it became apparent that the cost to continue supplying downtown with 11.5-kv cables from nearby Brunot Island Station was climbing out of line. The best downtown location available to terminate 69-kv transmission was high-value land, totaling only 17,000 square feet . . . for a station which, if built as a conventional outdoor sub-station, would require up to 75,000! Duquesne's engineers diagramed the sub-station, submitted the idea to Westinghouse and jointly they worked out specifications for standardized equipment.

How this problem was solved, and Forbes Sub-Station erected, is detailed on the following pages.

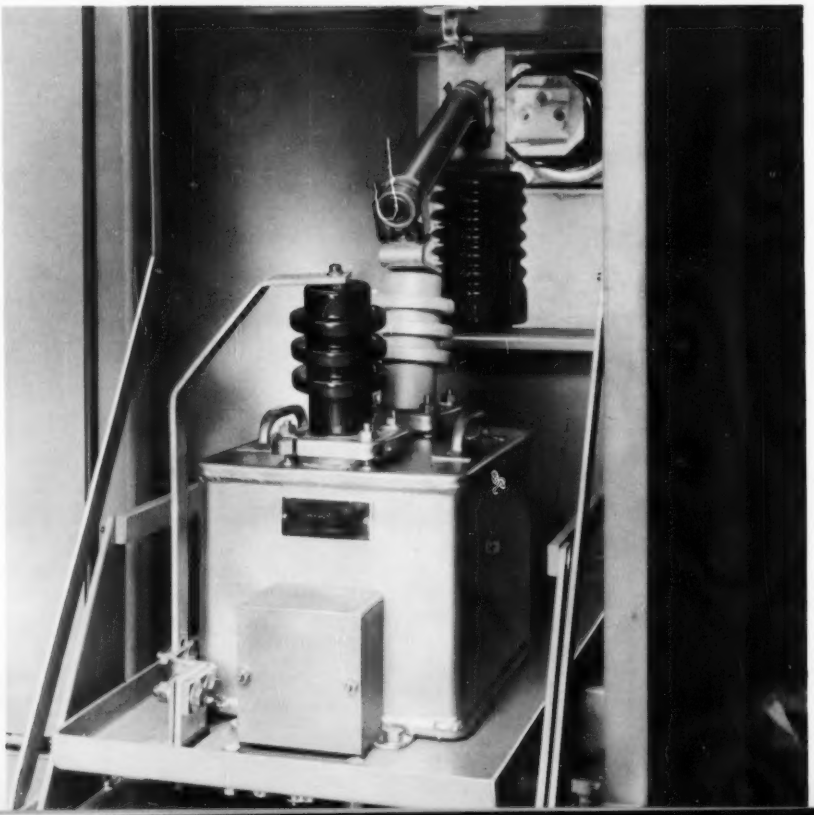
YOU CAN BE SURE... IF IT'S Westinghouse

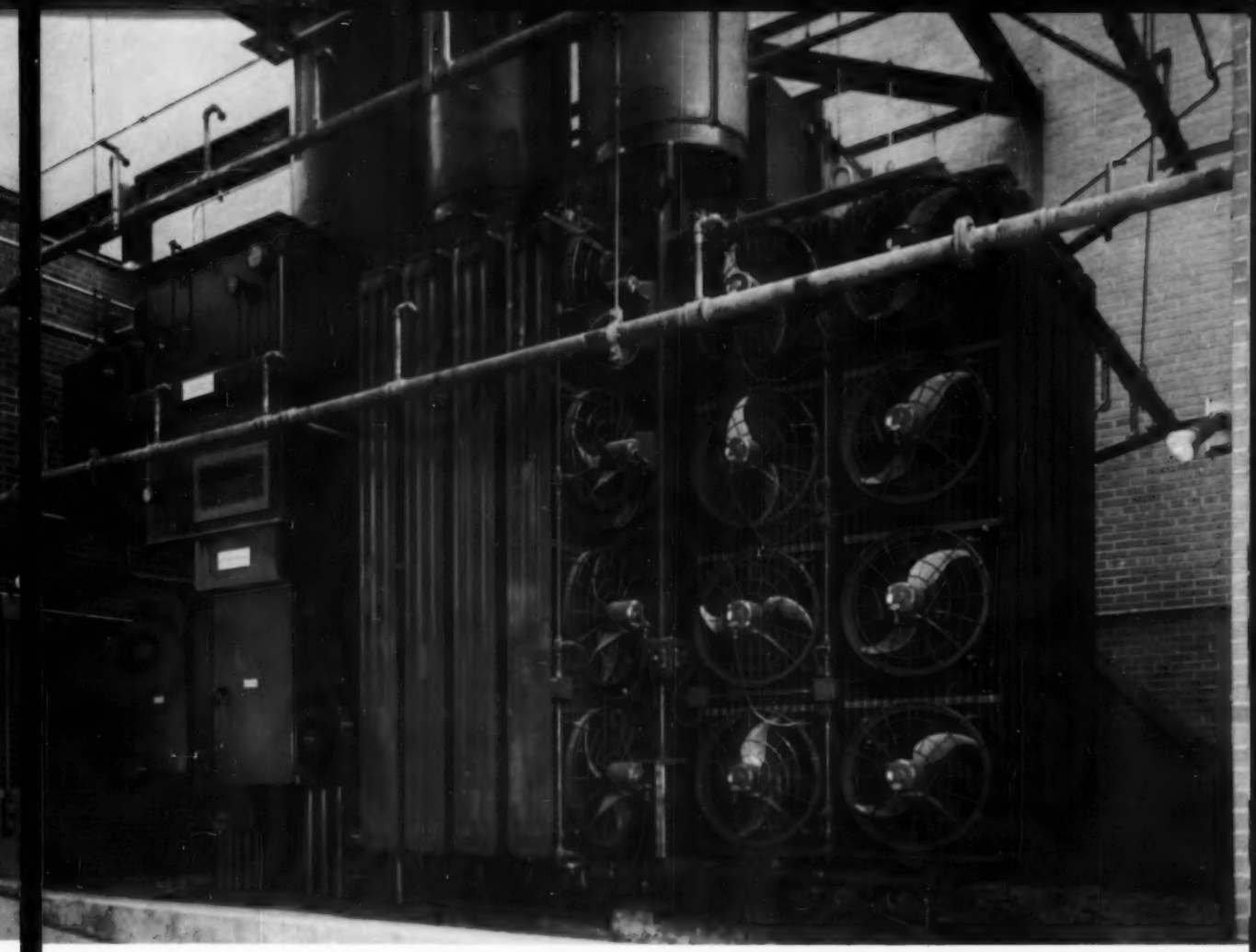




Compartment at top right of structure shows where 41,570/-69.28-volt nonflammable liquid insulated potential transformers (inset) were installed adjacent to overhead bus.

11.5-kv fused potential transformers with drawout disconnects serve to measure voltage on all three phases feeding switchhouse and two phases of each outgoing service to downtown networks.





Main power transformers are 30,000-40,000-kva air blast. Exclusive Westinghouse Form-Fit design contributed to compactness of station layout. In addition, 225-kva type SL station service transformers were mounted piggyback, with direct throat connection.

Unique transformer arrangement saves valuable space at Forbes

To shoehorn this high-capacity sub-station into one-fifth the normal space, maintain clearances and safety standards, called for a high degree of ingenuity.

Westinghouse Form-Fit® transformers, with their savings in bulk of 15% over comparable designs, contributed substantially to compactness, as the illustration above shows. But a 15% gain, when you're trying for better than 75%, is just one good step along the way.

To make the necessary additional gains, station service transformers were allocated "no space," mounted piggyback with direct throat connection to the main transformers. 69-kv potential transformers got the "no-space" treatment by mounting them in compartments along the overhead bus. Neutral resistors took full advantage of the wedge of open area between side and rear banks of radiators on main power transformers. In every single case, the compactness and lightness of Westinghouse transformer design simplified the spacesaving problem.

YOU CAN BE SURE...IF IT'S Westinghouse

Model illustrates compactness of Forbes Sub-Station layout. Three-story switchhouse is at rear. Dark indicates present installation; light, future expansion.

How Westinghouse bus, switches and breakers solved 69-kv clearance problems

For maximum dependability, within the clearances possible, isolated phase bus seemed the only choice for interconnection . . . but, at 69 kv, how much clearance? How much dependability?

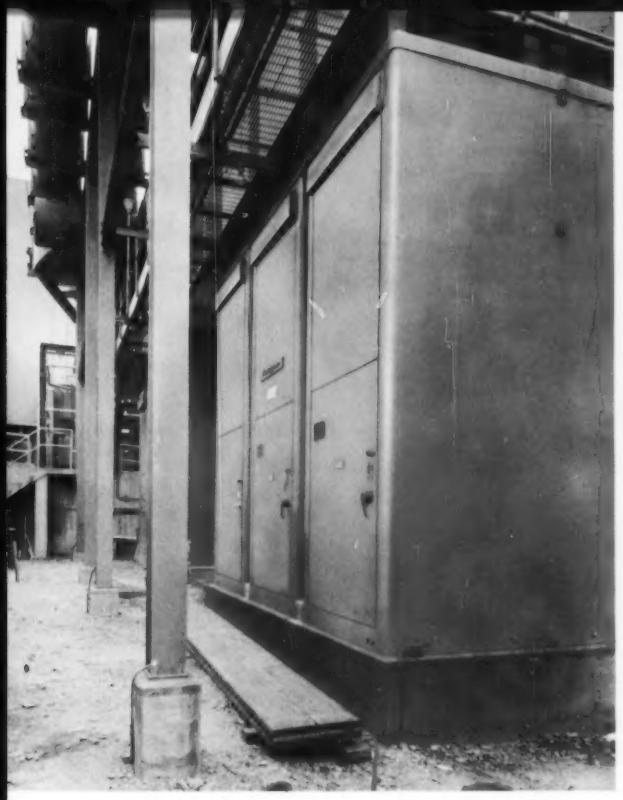
By actual tests, Westinghouse proved their design with enclosures of 38″ ID provided clearances adequate for the standard 350-kv BIL.

Similar problems arose with enclosed disconnect switches. The advantages of telescoping switches were recognized, but none had ever been built with a 69-kv rating. Basic Westinghouse electrical design was approved with the addition of a safety-check light box and viewing window by Duquesne engineers.

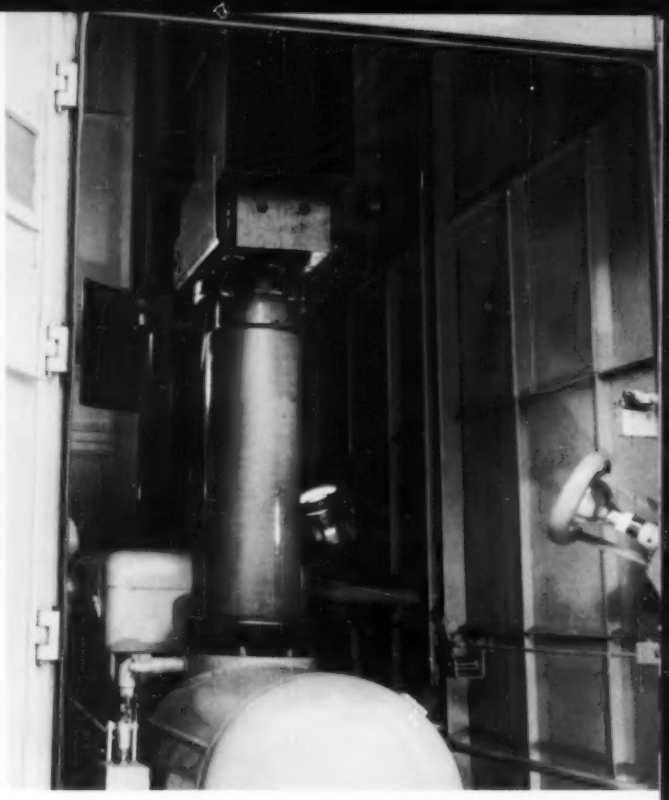
69-kv air blast breakers solved the problem of safely switching and protecting the circuit within the confines of a densely occupied area. Safe isolation of all high-voltage equipment was thus assured.

69-kv isolated phase bus connects incoming circuits, switchgear and transformers. Westinghouse bus with its enclosure of 38″ ID proved by tests that it would provide full 350-kv BIL for a 69-kv system.

YOU CAN BE SURE...IF IT'S Westinghouse

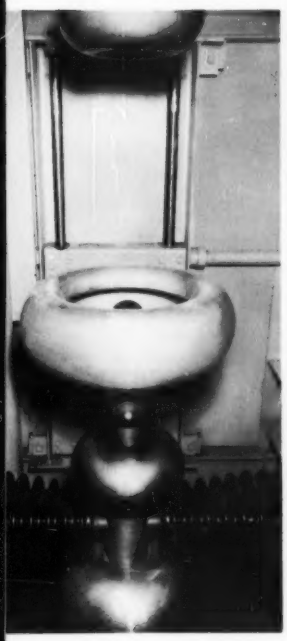


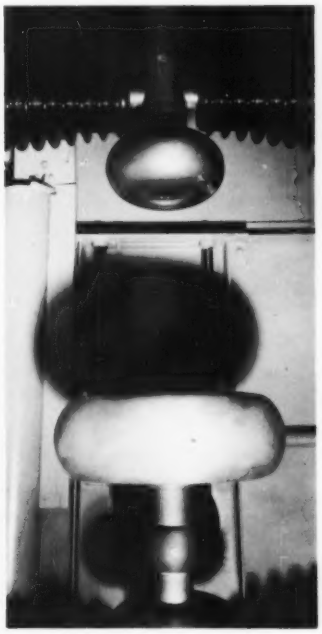
69-kv air blast breaker compartments. All breakers in the station are operated from a central air supply inside the switchhouse, eliminating necessity for individual compressors and associated maintenance.



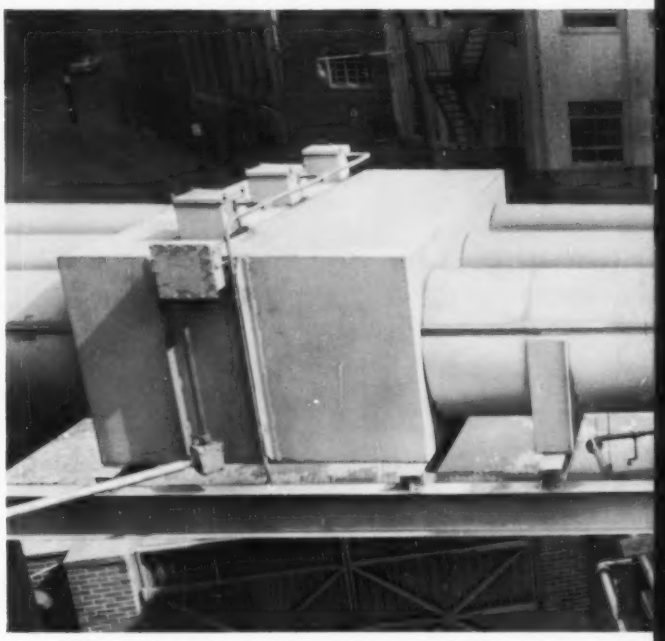
Interior view, 69-kv air breakers, rated 3500 mva, 2,000 amperes. Circuit is first interrupted in vertical chamber, top foreground. An isolating disconnect switch behind the chamber then opens while the circuit is interrupted.

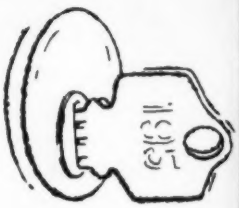
Telescoping bus disconnects, a design long known to the industry, had never before been applied to voltages as high as 69 kv. Large bowl-like corona shields surround the contacts.





The disconnect switches shown are horizontally mounted. The light boxes shown on the top of this installation, together with windows on the underside, provide a quick visual check of contact position from ground level.

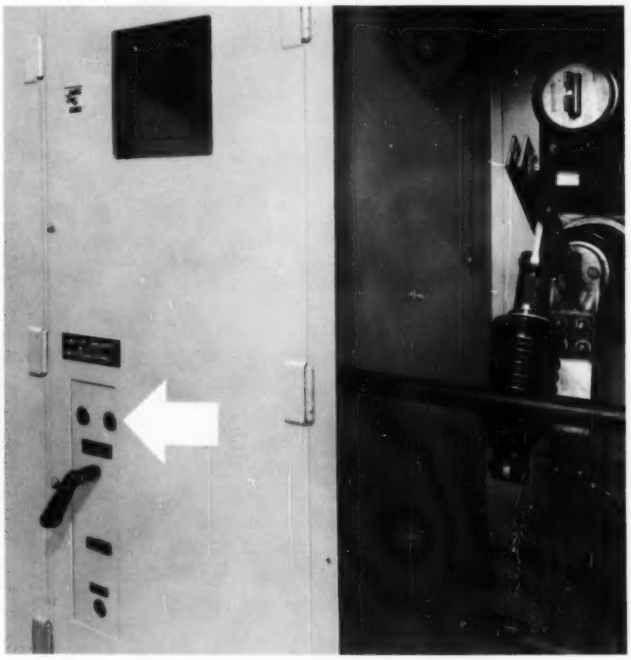




Interlocking keys assure safety of 11.5-kv station cubicles

Protection of circuits and of personnel are given equal emphasis in the new Westinghouse switchgear for the 11.5-kv lines. As breaker contacts part, air blast carries the arc upward into a breakup chute, extinguishing it and cooling any gases before they are released, assuring safe, positive circuit interruption.

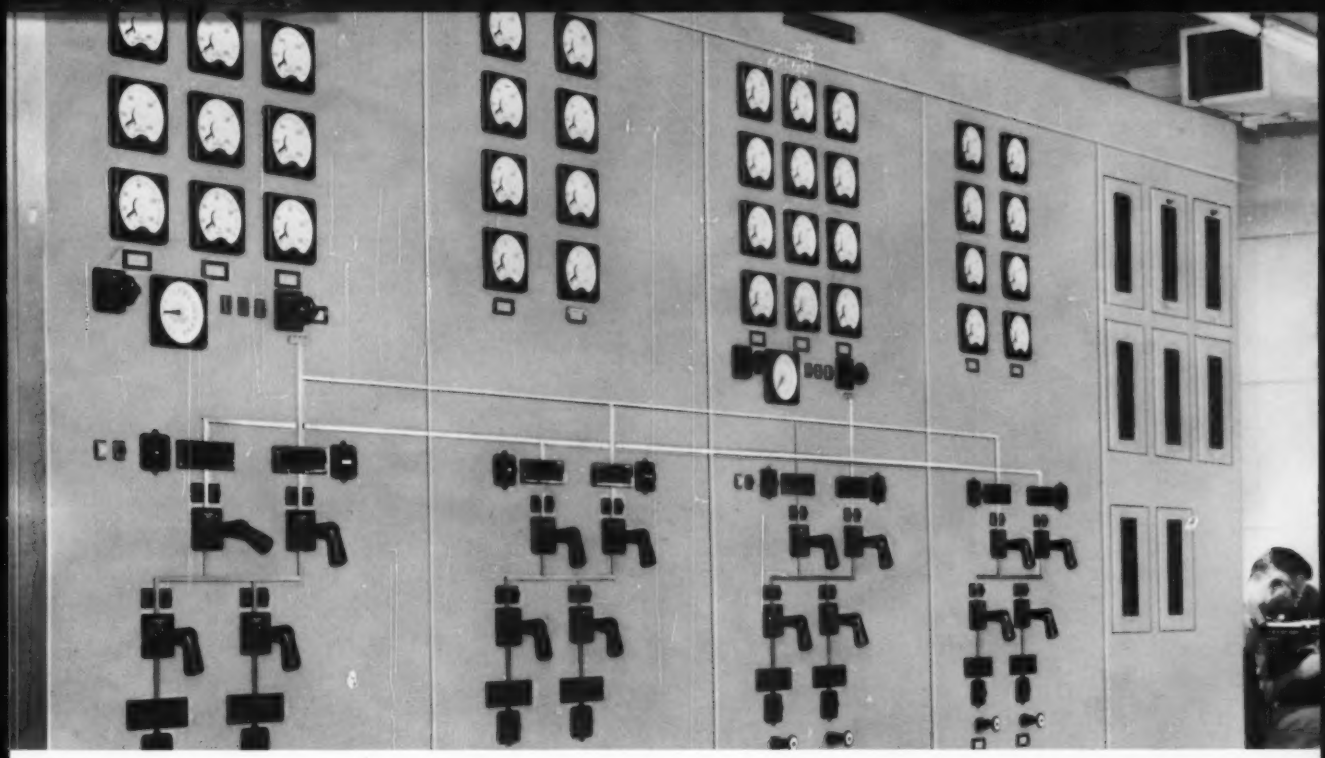
Personnel safety is guarded by interlocking keys, which make certain that dead-front doors to breakers, operating mechanism and associated disconnects can be opened only in the proper sequence, and only when equipment is in safe position, eliminating the hazard of human error.



Disconnects in back of station cubicles isolate the breakers. Mechanical interlock handle with key mechanism (arrow) assures correct operation of breaker, disconnect switches and door.

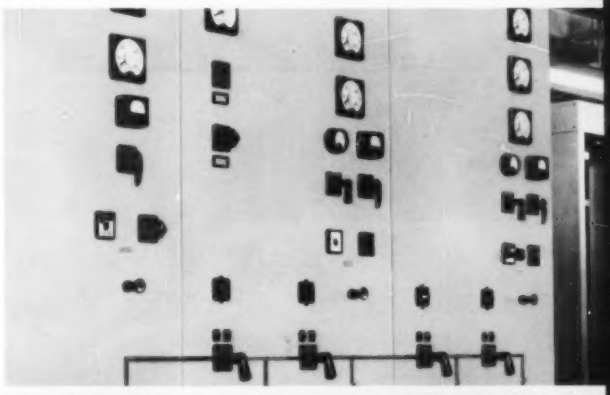
Station cubicles for 11.5-kv circuits contain 150-CA-1000 compressed air breakers. As a safety measure, doors interlock so that key (protruding above left) must be inserted and B phase opened before A and C will release. Similar key permits manual operation of breaker.

YOU CAN BE SURE... IF IT'S



These panels control 11.5-kv feeders to one downtown network area. Annunciator panel at the right reports troubles on the major equipment and each of the three groups send a signal to the dispatcher's office.

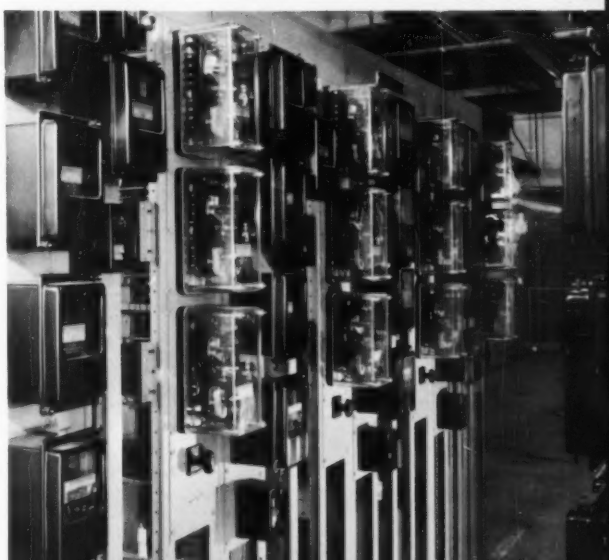
Controls for the 69-kv circuits are contained in the panels shown below. In general service, station will be unmanned, operated by remote control.



Forbes Sub-Station remote controlled

Although equipped for on-site operation from the third floor of the switchhouse, Forbes Sub-Station is designed for remote control from the system dispatcher's office located in the company's main office building, six blocks away in the heart of the downtown business district.

This floor also contains one of the most modern relay protective setups in the industry. On panels designed by Duquesne Light and fabricated by Westinghouse, CO and CA relays provide bus overload and differential protection, JD timing devices check back-up, and Type COH relays protect networks against overload.



One of the relay panels located on the third floor of the switchhouse. Westinghouse CO and CA-6 relays in the foreground provide 11.5-kv bus overload and backup protection.

Westinghouse

Frank Adkins, Westinghouse salesman, is proud of Forbes Sub-Station!

Frank Adkins has reason to glow with pride when you mention Forbes Sub-Station. From idea stage all through construction, Frank played the role of "Mr. Westinghouse" to Duquesne Light Company.

Frank takes no personal credit. He represented the hundreds of engineers, the thousands of workmen who designed and built the equipment.

"One contact, one responsibility" meant a lot to Duquesne Light during this period. That's why the men of Duquesne think highly of Frank. That's why we believe you, too, will find it advantageous to deal with the Westinghouse representatives throughout the country who can serve you as "one contact, one responsibility." C. P-1040

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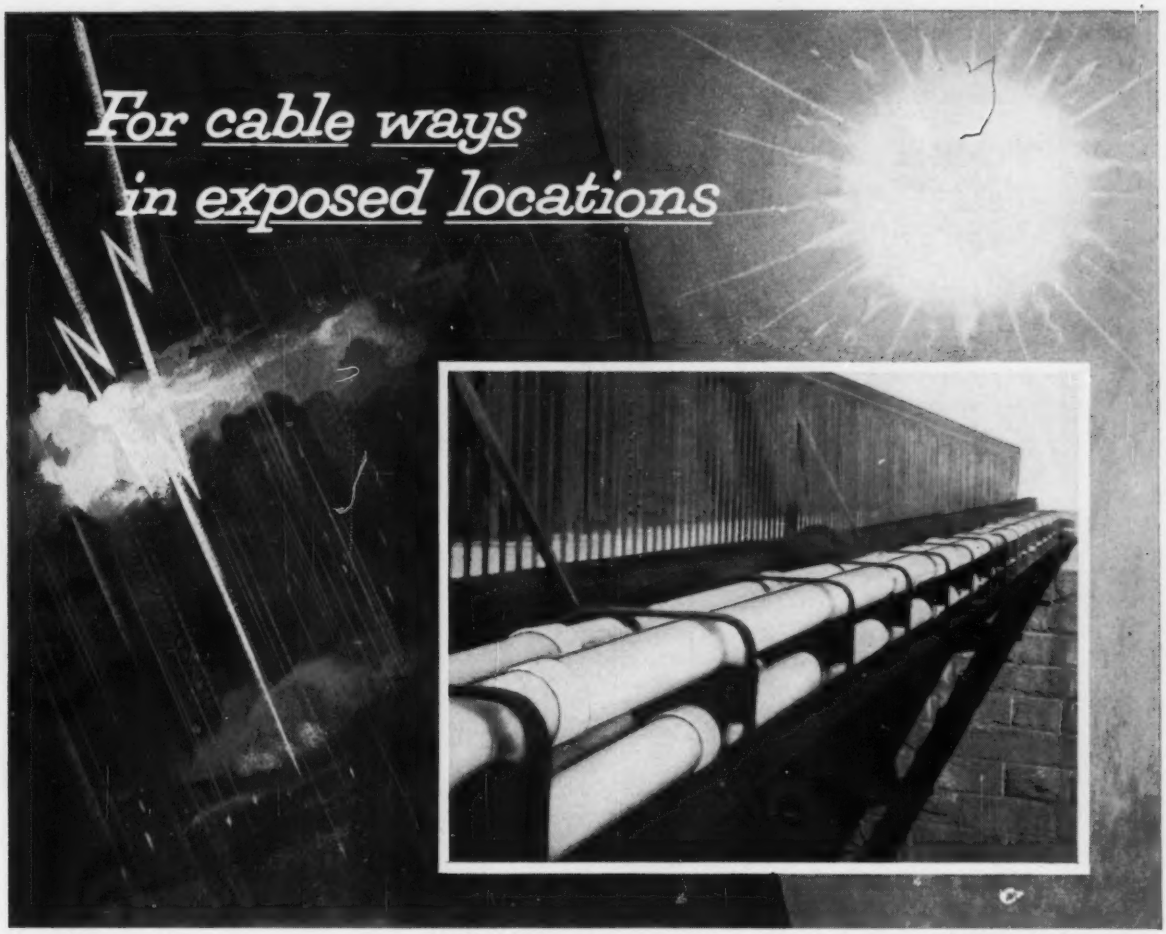

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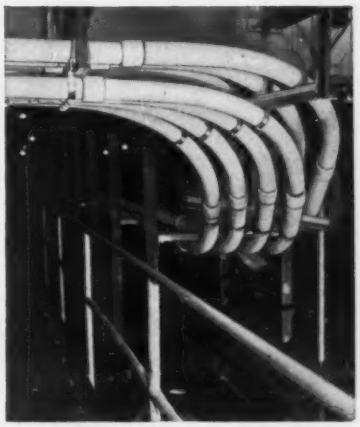
J-M Transite® Ducts give long, trouble-free service ...never rust, rot, or corrode

Wherever you *see* conduit—in exposed locations indoors or out—you see more and more of the conduit that *really* protects—Johns-Manville Asbestos-Cement Transite Ducts.

To cut circuit losses, Transite provides complete circuit isolation with a non-conductive, non-inductive barrier of asbestos and cement. Because it is made of incombustible, completely inert materials, Transite protects adjacent cable runs from the flame and heat of burnouts even at extreme temperatures.

To eliminate raceway maintenance, Johns-Manville Transite Ducts offer you a raceway that is built to take exposure to weather and corrosive atmospheres. No need to paint and repaint—because Transite resists corrosion, fungus, and rot—resists the heat and flame of extreme-temperature burnouts.

Let us send you free brochure EL-29A. Write Johns-Manville, Box 14, New York 16, New York. In Canada: Port Credit, Ontario.



INDOORS—Transite's light weight, quickly assembled tapered couplings, and pre-shaped bends offer installation speed to match Transite's low maintenance requirements.

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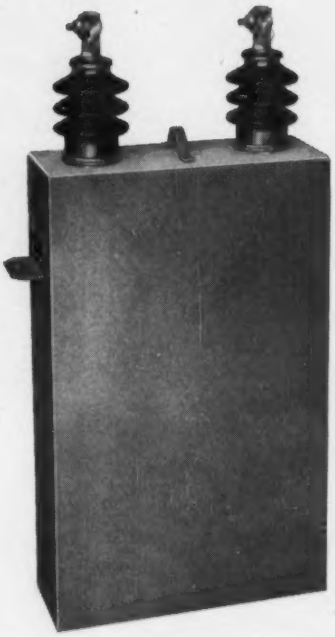
Made of Asbestos-Cement

J-M Conduit for exposed and underground installations without concrete
J-M Korduct® for installation in concrete

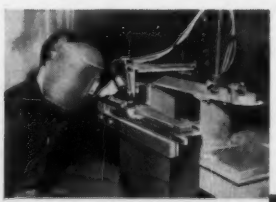
TOBE...tomorrow's certainties out of today's experiments!

CAPACITOR PROGRESS does not start in the laboratory. It has its origin in the needs of utility companies. TOBE translates those needs into the research that makes tomorrow's progress possible.

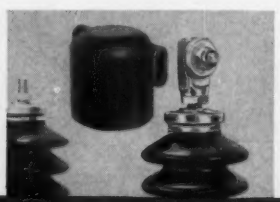
RESULT: progressive engineering of the type that has *resulted in* the famous TOBE 50-KVAR capacitor . . . *In* a stainless steel container at no extra cost . . . *In* low losses that mean more correction for less dollars . . . *In* design and processing procedures that assure thermal stability over the entire operating range. Yes, it will pay you to investigate TOBE TEMPALL power capacitors today! Write Tobe Deutschmann Corporation, Norwood, Mass. or call Norwood 7-2620, collect—for further information on power capacitors today.



HERE'S WHY BETTER POWER CAPACITORS COME FROM TOBE—



Heliarc weld virtually seamless stainless steel container.



One piece wet-process solder-sealed porcelain terminals equipped with self-locking neoprene caps.

Special TOBE assembly control mechanism results in greater product uniformity.

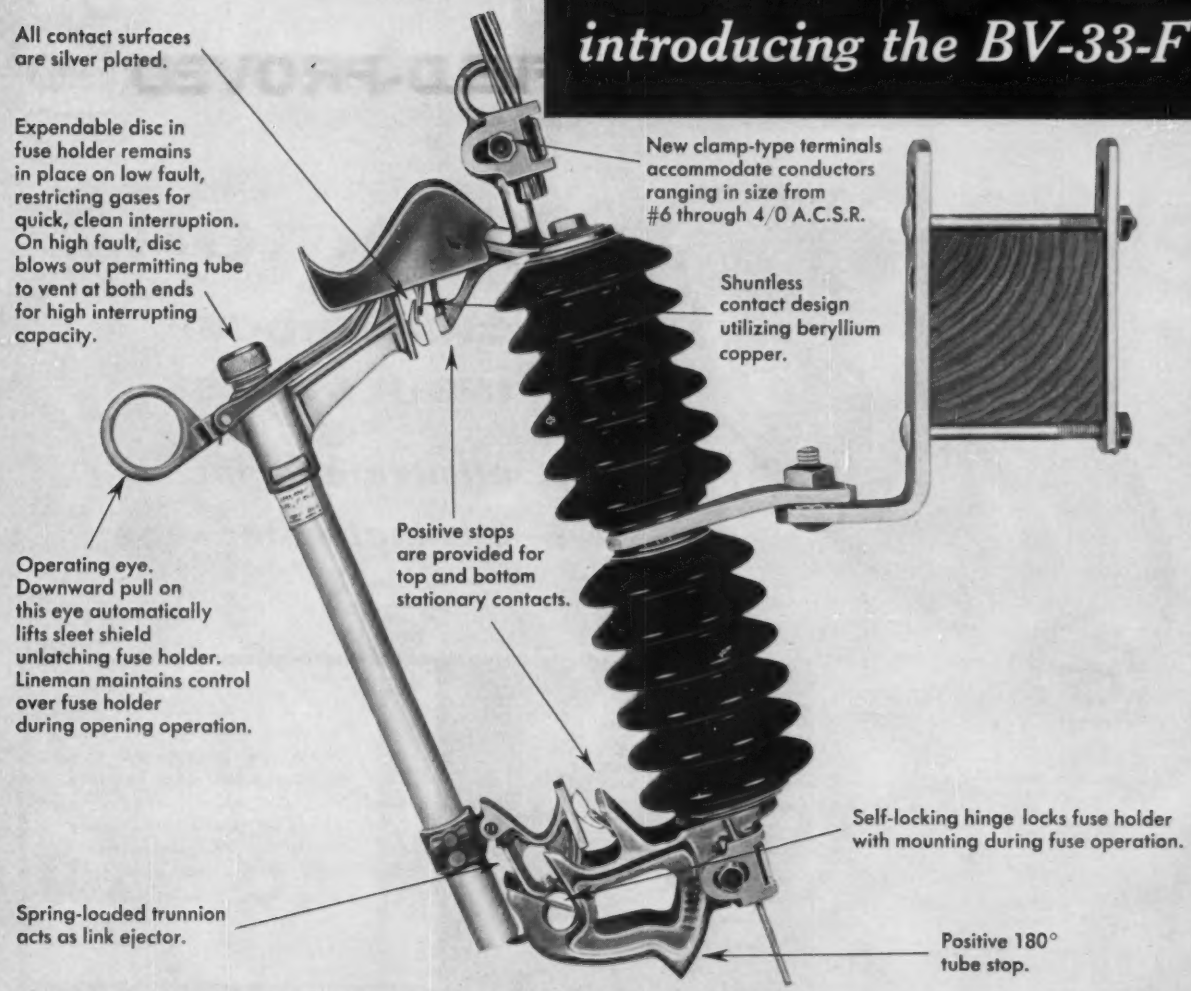
Another TOBE exclusive: checks on each capacitor during every step of processing.

Look to TOBE for progress. Since 1920 persistent research, trustworthy engineering, rigid production standards.

TOBE

TEMPALL CAPACITORS

introducing the BV-33-F


All contact surfaces are silver plated.
Expendable disc in fuse holder remains in place on low fault, restricting gases for quick, clean interruption. On high fault, disc blows out permitting tube to vent at both ends for high interrupting capacity.
New clamp-type terminals accommodate conductors ranging in size from #6 through 4/0 A.C.S.R.
Shuntless contact design utilizing beryllium copper.
Positive stops are provided for top and bottom stationary contacts.
Operating eye. Downward pull on this eye automatically lifts sleet shield unlatching fuse holder. Lineman maintains control over fuse holder during opening operation.
Self-locking hinge locks fuse holder with mounting during fuse operation.
Spring-loaded trunnion acts as link ejector.
Positive 180° tube stop.

A Powerful New Southern States Cutout For Handling Restricted or Heavy Faults

CHECK THE FEATURES of the powerful new BV-33-F! Whether you are a lineman, or an engineer responsible for applying cutouts on an entire system, we believe the BV-33-F will meet your requirements.

Despite its exceptionally high interrupting rating the BV-33-F clears restricted faults quickly and cleanly. Secret of its success on faults of any magnitude lies in the expendable disc in the fuse holder cap. On low faults the disc remains in place, restricting gases within the tube for maximum arc-quenching ability. On high faults the disc blows out and the cutout double-vents for maximum interrupting capacity.

The BV-33-F can be easily converted to a single-vented SV-33-F by replacing the pressure relieving cap with a solid cap.

For additional information on these new cutouts contact your local Southern States representative.

CHECK THESE INTERRUPTING RATINGS

KV	Continuous Current Amps	Interrupting Capacity RMS Amps
TYPE BV-33-F		
5	100	8,000
7.5	100	8,000
15	100	6,000
25	100	4,000
TYPE BV-33-FH		
5	100	10,000
5	200	10,000
7.5	100	10,000
7.5	200	10,000
15	100	8,000
15	200	8,000
25	100	5,000

IN CANADA: Dominion Cutout Co., Ltd., Toronto

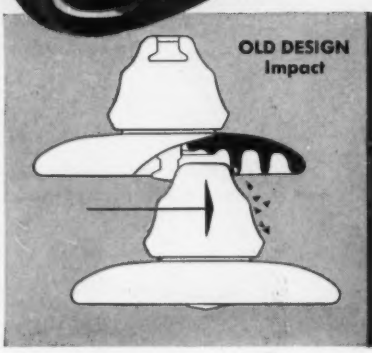
SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

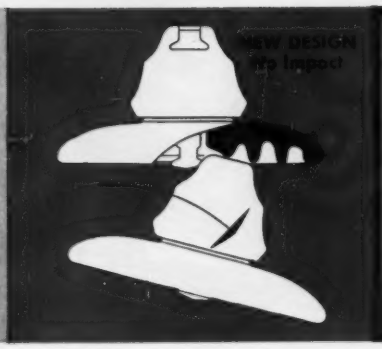
TIME-TESTED AND FIELD-PROVED

Thomas

"CHIP-PROOF" INSULATORS*

- *eliminate impact*
- *eliminate breakage*





A close look at the two drawings points out the reason why. The Thomas design eliminates the cause of breakage. It prevents impact. Eliminate impact and you eliminate breakage. It's as simple as that.

In 1953, Thomas introduced the "Chip-Proof" insulator, designed to eliminate breakage caused by rough handling and assembling in the field. Today, utility service records have proved its worth in stopping breakage during assembly or disassembly of insulator strings. Here's why:

Thomas "Chip-Proof" design uses a "diverter skirt" — a heavy corrugation that can't break, designed with a contour that actually diverts the lower insulator or fitting away from the petticoats. No matter how roughly the insulators are handled, when the cap is pulled off the ball pin, it will first strike the diverter. This glancing blow deflects impact away from the lighter petticoats. Result: no chipping, no breaking . . . and a more rugged insulator.

Thomas "Chip-Proof" suspension insulators conform to the latest EEI-NEMA Standards (Classes 52-3 and 52-4) and are interchangeable with other units.

Throughout the country, wherever "Chip-Proof" insulators are now in use, their performance record speaks for itself. See your nearest representative today and ask for a demonstration.

Specify Thomas Insulators — The Best by Line Test.

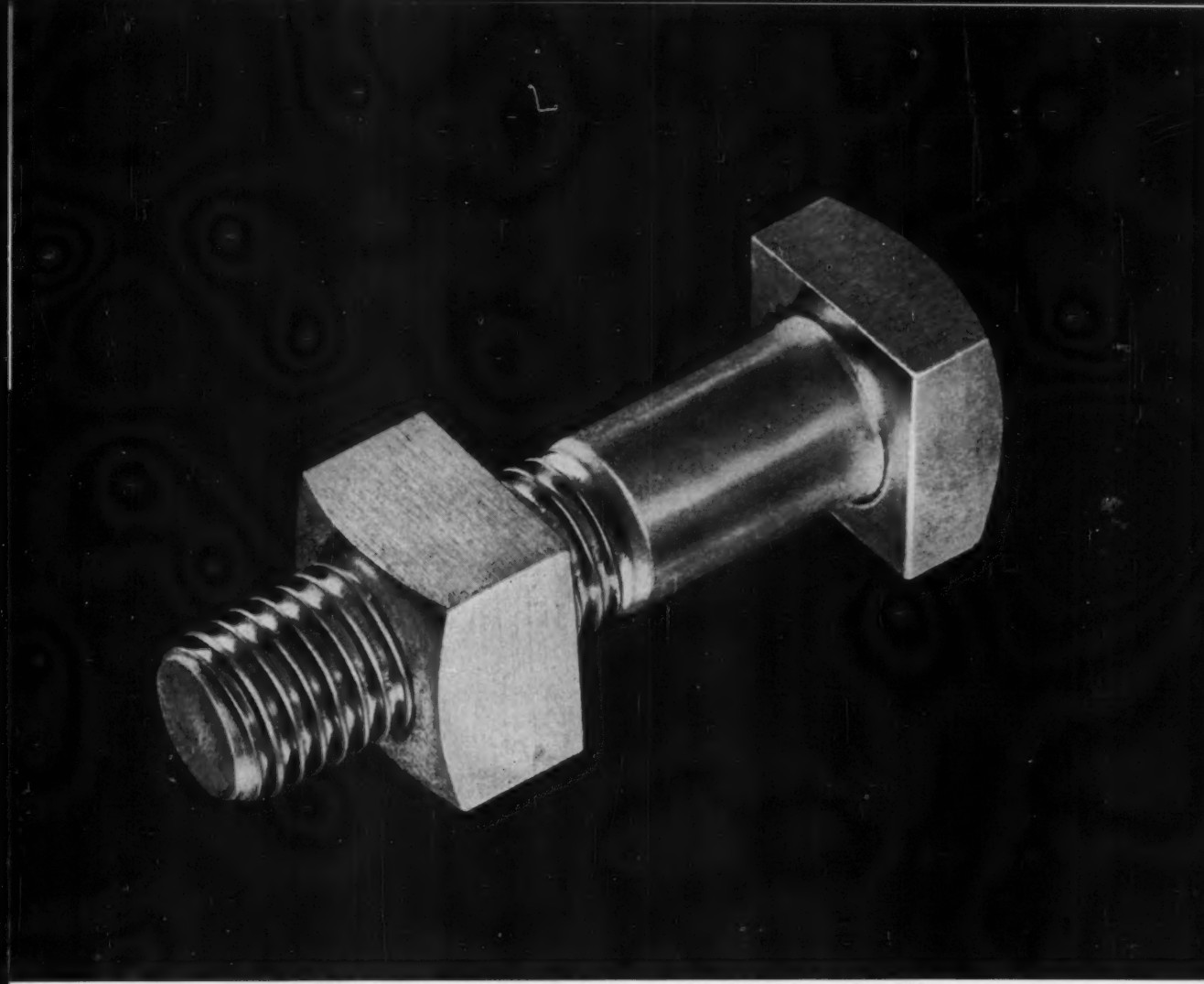
**Patent applied for*

Write for NEW Thomas EEI-NEMA Standards Bulletin

The R. Thomas and Sons Co.

LISBON, OHIO

1873 THOMAS INSULATORS our 84th year RELIABILITY 1957



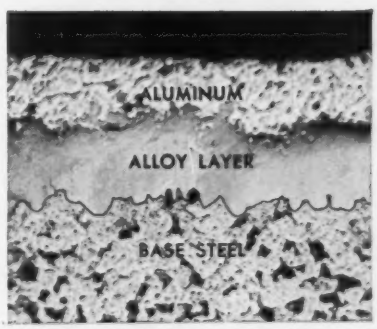
The Bethalume process produces an unusually uniform coating, ensuring clean threads for good fit.

Bethalume Coating Gives Fasteners Better Resistance to Corrosion

Fasteners used in corrosive atmospheres have a much longer service life, and require little or no maintenance, when protected by Bethlehem's Bethalume coating—a hot-dip coating of pure aluminum.

The Bethalume coating is effective in enabling fastener items to withstand the effects of corrosive atmospheres because it adds the permanence of aluminum to the strength of steel. The coating is tightly bonded to the base steel, and is uniform over the entire surface of the fastener. The coated threads are clean and smooth-fitting.

Why not look into the advantages of the Bethalume coating for your fasteners applications? A telephone call to the nearest Bethlehem sales office will bring one of our representatives to your desk promptly.



Photomicrograph of Bethalume coating. Pure aluminum is bonded to base steel by iron-aluminum alloy.

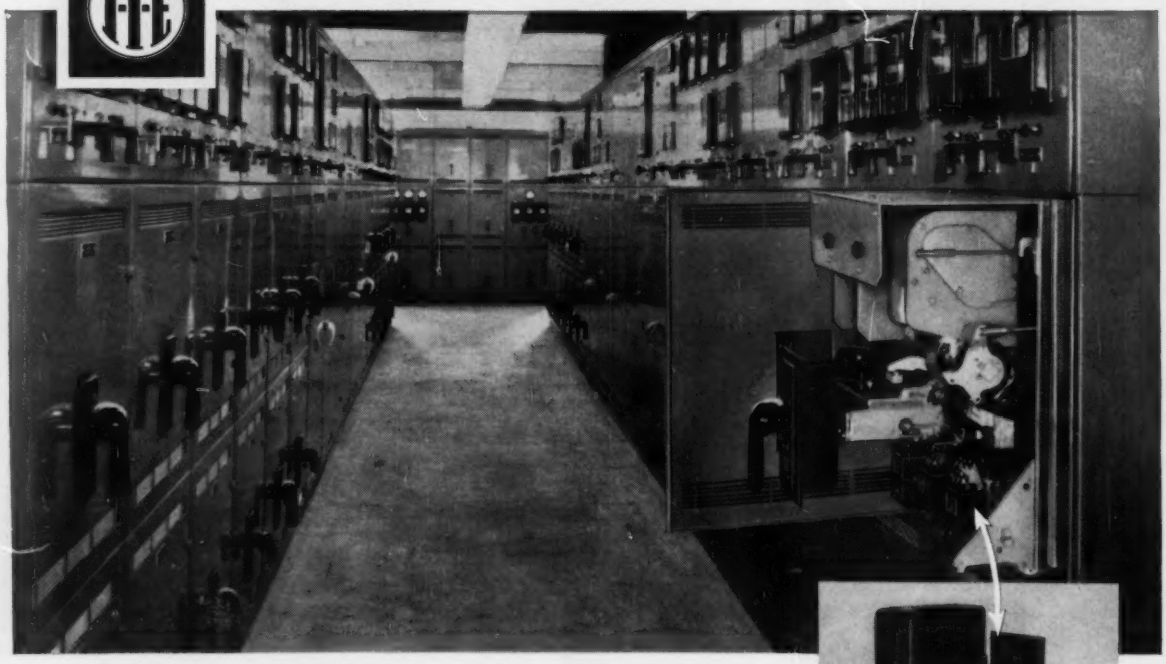
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

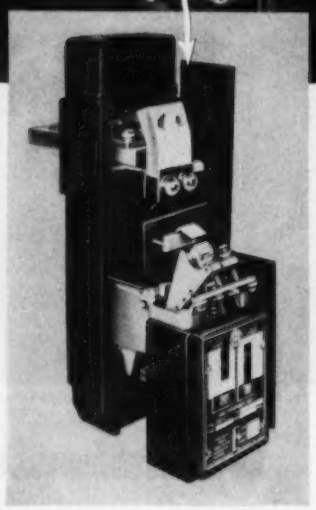
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

LOW VOLTAGE SWITCHGEAR





Here's SENSITIVE Circuit Protection

Some temporary overcurrents are tolerable; should even be permitted to occur. But sensitive circuit protection is needed to interrupt them when they persist too long or are of too high a magnitude.

The I-T-E Type OD-1 dual magnetic overcurrent trip device gives such protection. It permits temporary overcurrents, but limits them in duration and magnitude. This device will trip the circuit breaker after a predetermined interval on relatively low overcurrents or will trip instantaneously on high-magnitude fault currents. In either case you get safe, positive protection—sensitive to the needs of the circuit and the equipment on it.

For complete information on sensitive circuit protection, including selective tripping, undervoltage and other tripping devices, contact your local I-T-E sales representative. Or write for Bulletin 6004B. I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.

Features of the I-T-E Type OD-1 Trip Device

PRECISION BUILT and factory calibrated to provide the highest possible accuracy in operation.

SEALED SILICONE TIMING ELEMENT. No maintenance. No oil to handle, no level to maintain, no sludging.

QUIET. Resonant vibration dampeners prevent a-c noise and wear on parts.

COMPLETELY ADJUSTABLE IN SERVICE. The delay pickup is easily adjusted from 80 to 160% of the continuous current rating. The instantaneous pickup is adjustable from 500 to 1500% of the continuous current rating. The time delay is adjustable to any of three time delay bands—minimum, intermediate and maximum.

SAFE DEAD FRONT DESIGN. Insulated knobs permit safe adjustment on a *hot* circuit breaker.

DEPENDABLE impact tripping action. The *hammer blow* movement of the time delay armature at end of timing stroke gives positive operation.

FAST RESETTING. Sensitive check valve on the piston provides quick resetting of the time delay. Repeat tripping is assured.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

IN CANADA: EASTERN POWER DEVICES, LTD.

ANDERSON ELECTRIC

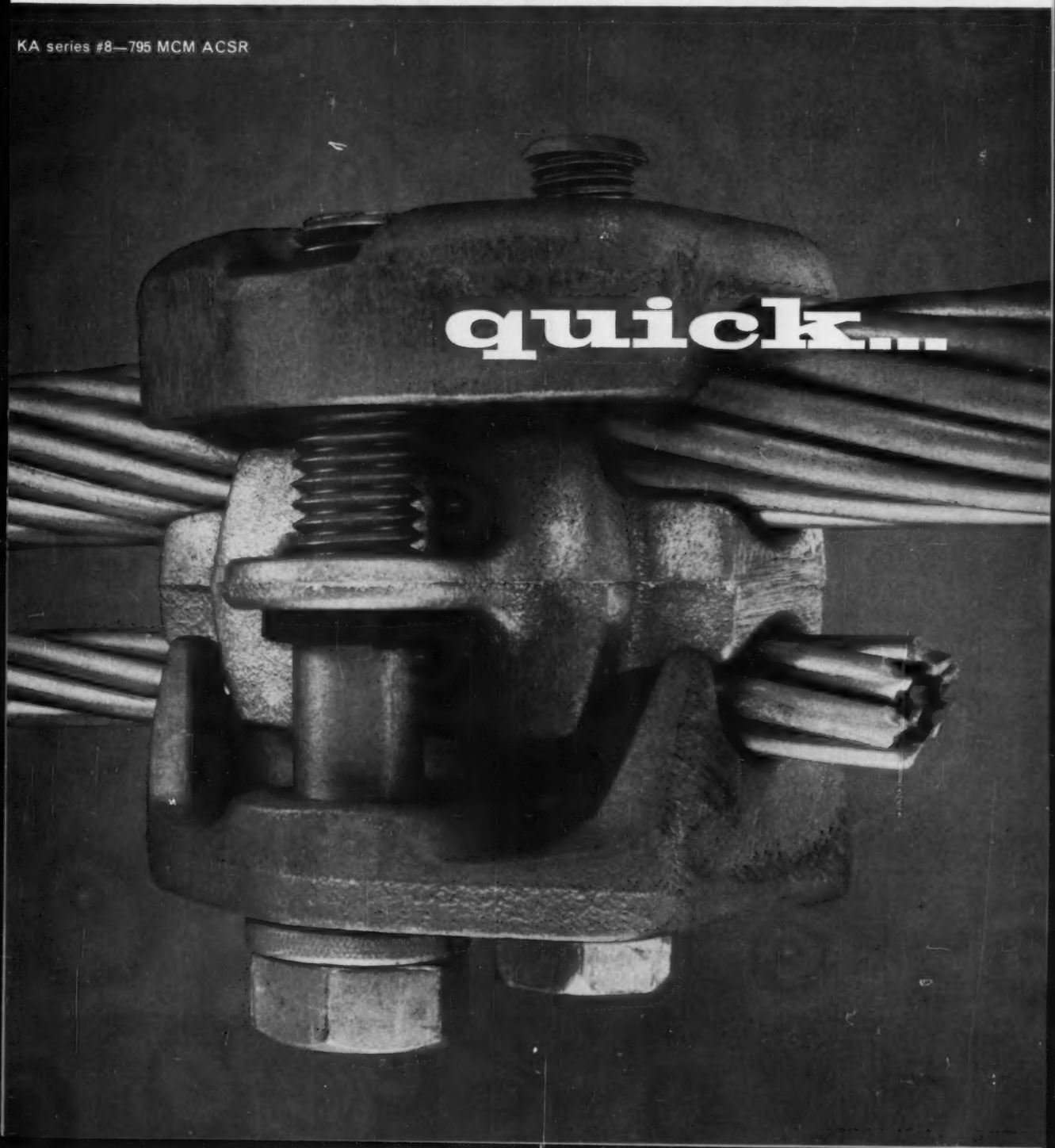
Swivel action is the secret of Anderson Electric's KA series aluminum parallel groove Connectors. A peened bolt with rotating cap allows safe, quick, "Hot-Line" work as well as one piece design. The COVER-ALL spacer, an exclusive Anderson feature, assures greater contact area, added inhibitor protection and reduced cable distortion.

ANDERSON ELECTRIC CORPORATION
Birmingham 1, Alabama.

Export Representative: International Standard Electric Corp.

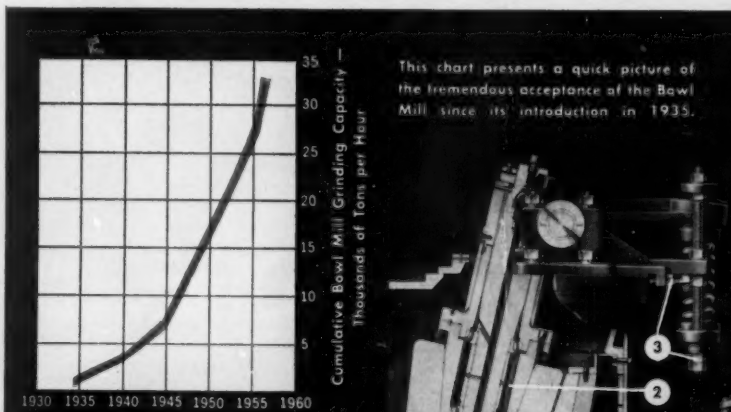
Aluminum & Bronze Power Connectors • Clamps • Fittings • Accessories for SUBSTATION • TRANSMISSION • DISTRIBUTION

KA series #8—795 MCM ACSR

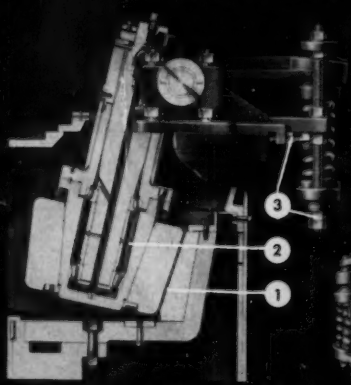


Why the Bowl Mill is

AMERICA'S No. 1 PULVERIZER

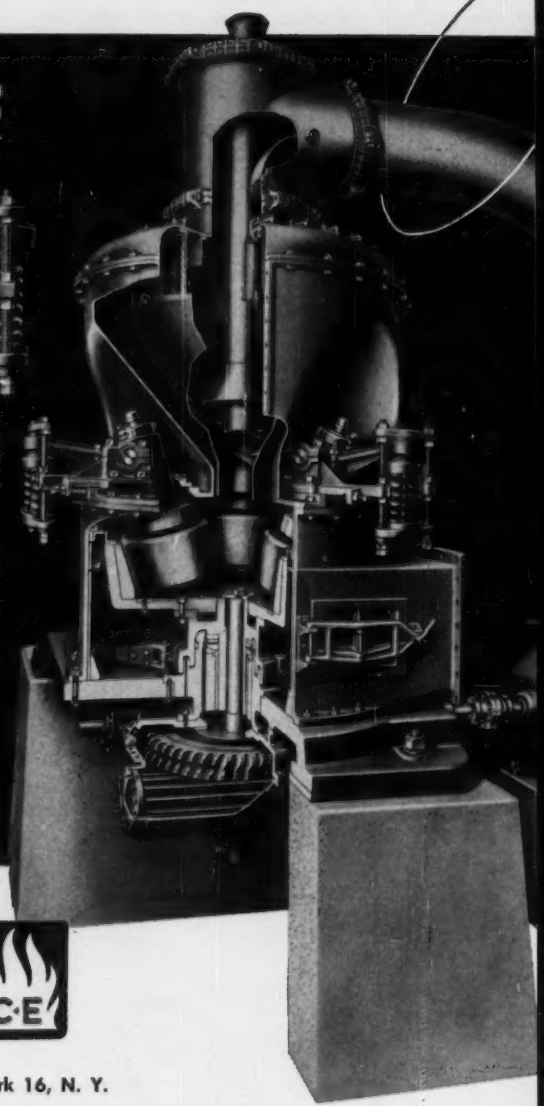


This chart presents a quick picture of the tremendous acceptance of the Bowl Mill since its introduction in 1935.



Cutaway view showing assembly of roller journal in bowl. Note: 1 — no metal-to-metal contact; 2 — self contained lubrication system (no grease cups); 3 — convenient method of adjustment without dismantling.

Looking down on top of mill. See handy arrangement of levers which adjust vanes — while in operation — to control fineness of coal leaving mill.



COMBUSTION ENGINEERING

C-E

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.
Canada: Combustion Engineering-Superheater Ltd.

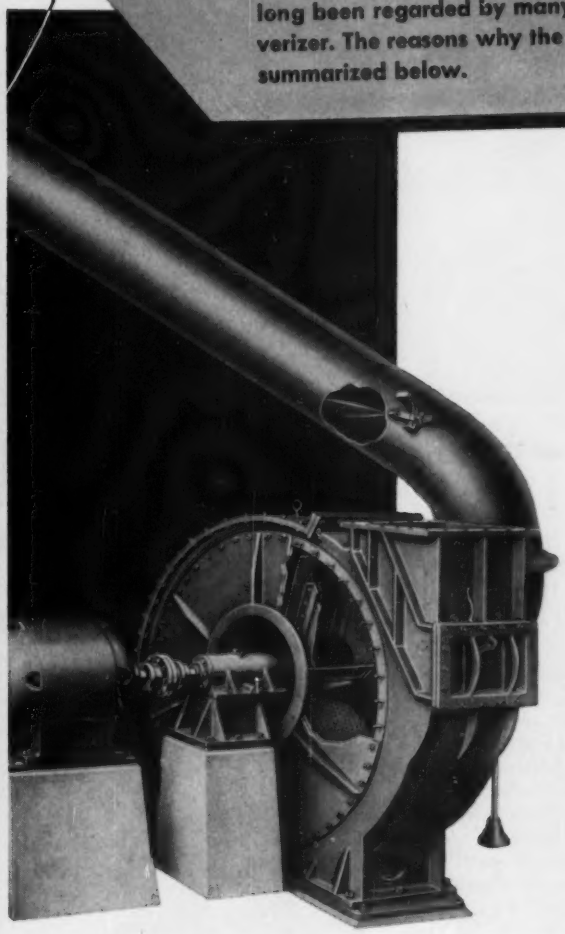
B-987

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS;

A first-class pulverizer should possess certain basic capabilities of which the following — most operators will agree — are the most important. They are the ability to . . .

- *handle high moisture fuels without difficulty*
- *operate with low power requirement*
- *stay in continuous service for long periods*
- *operate with low maintenance costs*
- *permit convenient control of fineness while running*
- *adjust grinding pressure automatically*
- *lubricate, when required, while in operation*
- *operate quietly and without vibration*

It is because the C-E Raymond Bowl Mill measures up on *all* these points that it has long been regarded by many leading power engineers as the country's No. 1 pulverizer. The reasons why the Bowl Mill is an outstanding all-around performer are summarized below.



HIGH MOISTURE — The most effective means of achieving good pulverizing results with high moisture fuels (16 – 18% – Eastern coal, 24% Midwestern, 45 – 50% lignites) are (1) by the admixture of fuel already dried in the mill with the raw feed and (2) by the use of high temperature air. The C-E Raymond Bowl Mill was designed to do both of those things, and does them well. Air temperatures of 700° F. and above can be utilized.

LOW POWER CONSUMPTION — Basic design characteristics of the Bowl Mill permit pulverizing at less power per ton of material than any mill now available. The rapid flow of material through the mill and the prompt removal of fine coal as it is produced prevents over-grinding. This, in conjunction with the relatively low mass of grinding elements and rapid drying action in the mill, assures minimum power consumption.

RELIABILITY — Design and materials are responsible . . . but results prove the point — such results for example as operating records of 8500, 10,000, 15,000, 20,000 continuous service hours without repair or replacement of parts.

MAINTENANCE — Bowl Mill maintenance cost has always been the lowest in the field. Continuing improvements in designs, materials and construction keep it that way. A minimum of outage time is required for dismantling and assembly. It's a matter of record in many plants that higher costs of material and labor over the past 15 years have not been reflected in increased maintenance cost per ton of coal pulverized.

FINENESS CONTROL — All necessary adjustments to control fineness of finished product can be made conveniently from the outside of the pulverizer *while it is in operation.*

AUTOMATIC GRINDING PRESSURE — The arrangement of spring-loaded roller journals on the Bowl Mill provides automatic compensation for the variation in pressure between grinding surfaces required by variation in grindability of coals.

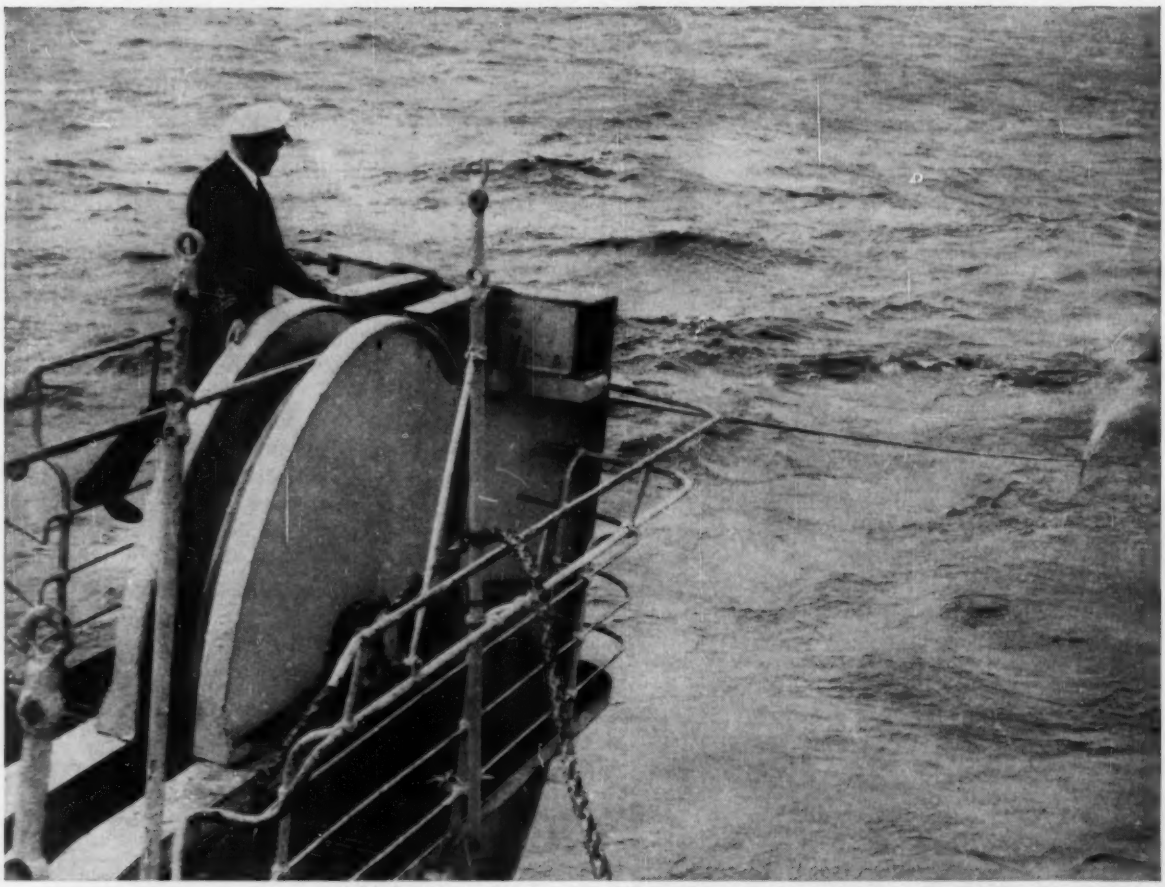
LUBRICATION — Is no problem with the Bowl Mill. When required — at infrequent intervals — all lubrication is handled from outside the mill while it is in service.

VIBRATIONLESS — QUIET — The Bowl Mill's grinding rollers make no metal-to-metal contact with the grinding ring, assuring quiet, vibrationless operation.

• • •

Whether you are evaluating pulverizers for your present plant expansion program or for future requirements, we suggest you use the above check list to get the facts. Send for Catalog PC-8 for further details.

PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

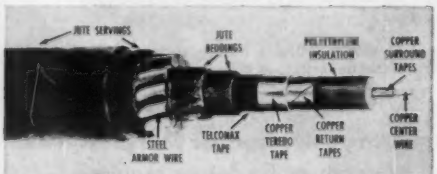


Cable leaving ship's stern must withstand the rigors of installation and give long, efficient service. BAKELITE polyethylene plays a vital role in meeting these requirements.

How BAKELITE Polyethylene serves . . .

On the bottom of the Atlantic Ocean

The electrical and physical properties combined in BAKELITE Brand Polyethylene Compound DFD-6505 make it especially useful for service in submarine cable. Its insulation values are excellent and its rate of moisture absorption extremely low. Physical properties, such as light weight, flexibility and resistance to cracking at low temperatures, further equip it for the rigorous installation and operational requirements imposed by the undersea environment.



Cutaway photo shows complex structure of this cable.

These are some of the reasons why Bakelite Polyethylene DFD-6505 is being used for the inner insulation of the American segment of the North Atlantic telephone line and the Alaskan cable, reaching 1600 miles between the state of Washington and Alaska. Since 1950, over 4,000 miles of submarine cable have been insulated with DFD-6505.

BAKELITE Brand Polyethylene and Vinyl covered wire and cable meet the demands of the telephone and communication industries. To keep informed about the latest developments, you can receive regular copies of Kabelitems and other pertinent technical data. Simply send your request to Dept. XJ-53.

BAKELITE BRAND POLYETHYLENE

BAKELITE COMPANY, *Division of Union Carbide Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

The term BAKELITE and the Trefoil Symbol are registered trade-marks of UCC.

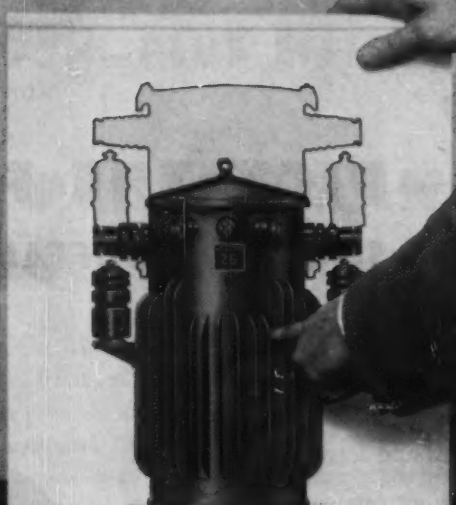
Your Westinghouse representative can prove...

NEW CHANGEOUT SAVINGS

Because all new Westinghouse transformers* are up to 13" shorter, 33% lighter, you can now make changeouts to next higher kva ratings without replacing poles or relocating secondaries

Among major utilities enjoying the advantages of Westinghouse "new-size" full-capacity transformers is Alabama Power Company, whose D. D. Wendel, manager of transmission and distribution, is seen here with John Main, Westinghouse Birmingham representative.

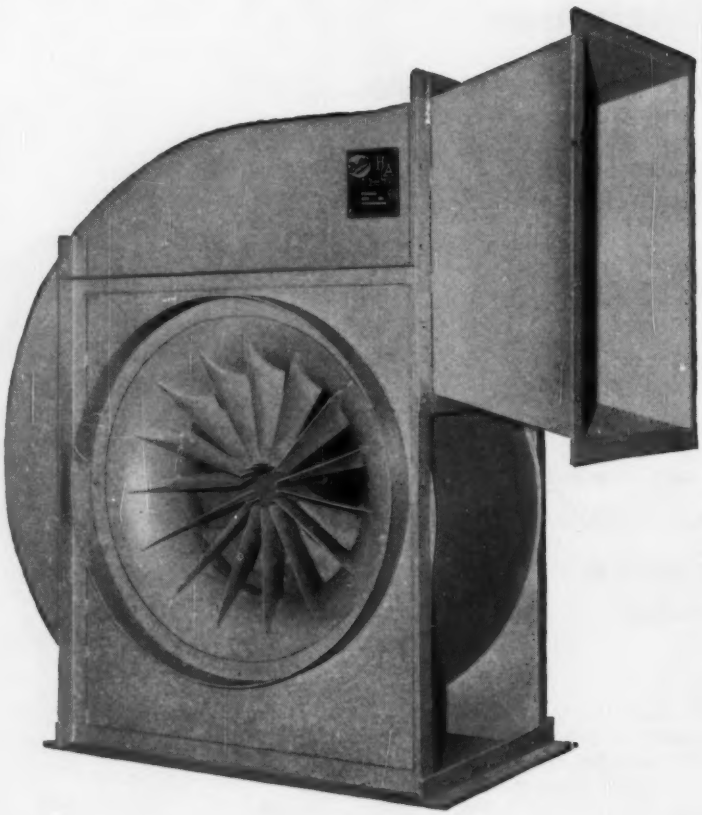
J-70787



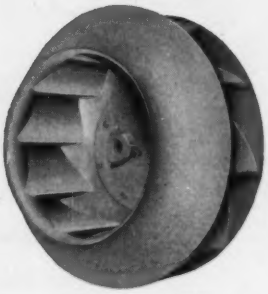
*All ratings 25-167 kva

YOU CAN BE SURE...IF IT'S

Westinghouse



TYPE "BA" WHEEL



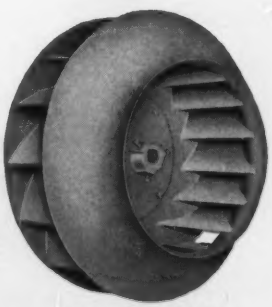
TYPE "CA" WHEEL

TYPE "AA" WHEEL

NOW—PICK THE FORCED

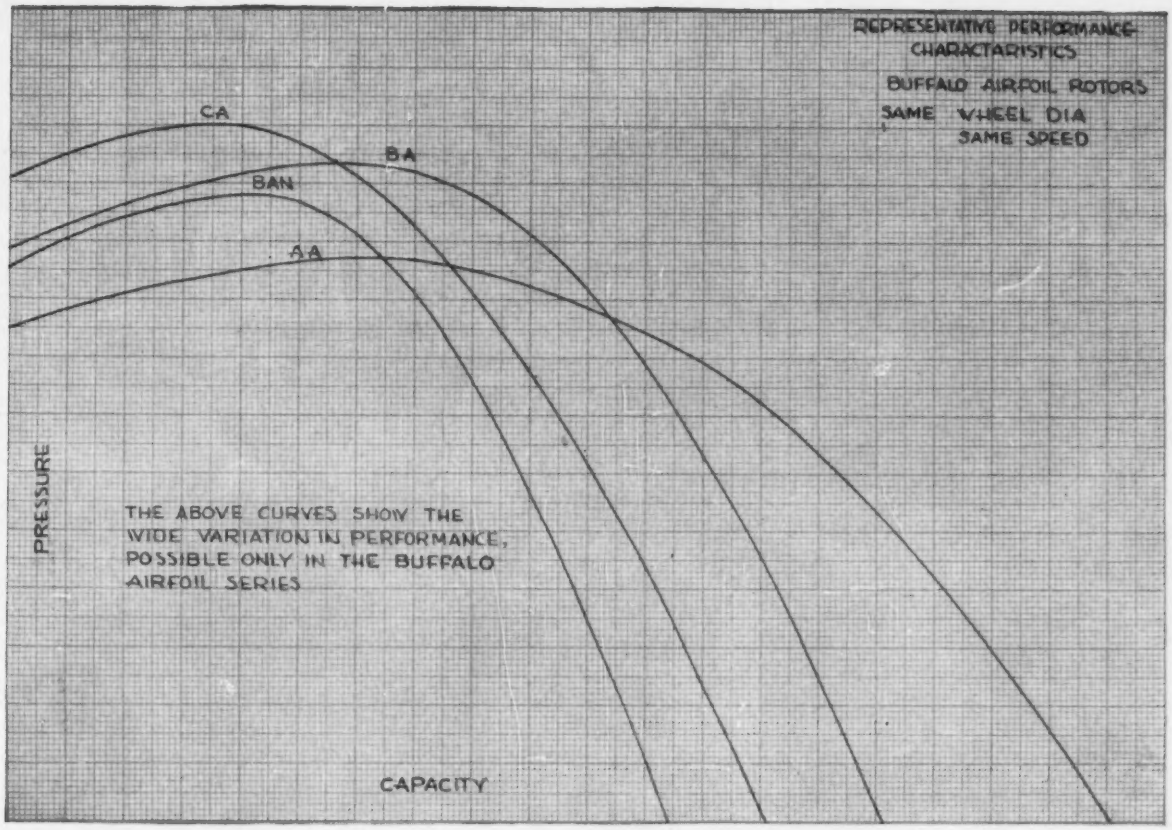
4 SERIES OF "BUFFALO" AIRFOIL

1. "BA", the basic wheel of the line — for many general forced draft and industrial requirements. Note broad air channels provided by extra-wide blades.
2. "CA", a wheel for higher pressures and lower capacities.
3. "AA", for lower pressures and higher capacities.
4. SEMI-AIRFOIL WHEELS like the "CLM", with airfoil noses and single thickness backward curved blades, closely approach performance of full airfoil wheels. This wheel has a definite application where a single thickness is advantageous.



TYPE "CLM" WHEEL

ALL WHEELS VARIABLE AS TO WIDTH, TO GIVE YOU PEAK EFFICIENCY FOR *YOUR* OPERATING CONDITIONS



ONLY "BUFFALO" BRINGS YOU THIS BROAD SELECTION—PLUS EFFICIENCIES UP TO 92%

DRAFT PERFORMANCE YOU WANT

FANS TO MATCH YOUR CONDITIONS EXACTLY

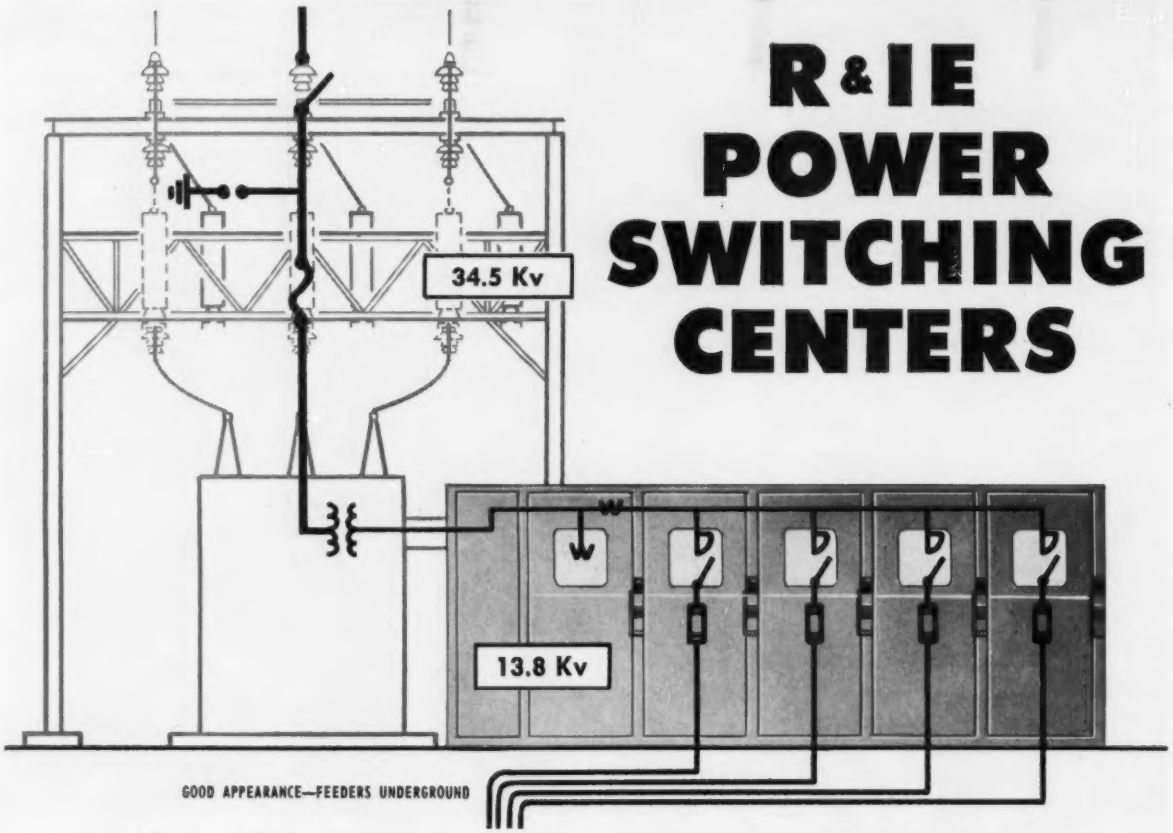
Not just an airfoil fan, but *four complete series* — six types of interchangeable airfoil and semi-airfoil wheels in varying widths — to give you maximum efficiency for your operating conditions! "Buffalo" deep-blade airfoil design offers a new high in forced draft efficiency — not just on paper, but in actual operation. In addition to the effective, high-strength airfoil and semi-airfoil blades, these "Buffalo" Fans go beyond the usual concept of streamlining. From the smoothly rounded inlet to the divergent outlet, all sources of turbulence has been eliminated. If you wish the highest possible efficiency in a forced draft fan tailor-made for your particular operation, by all means, write for Bulletin FD106 and our engineering recommendations.

BUFFALO FORGE COMPANY
BUFFALO, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

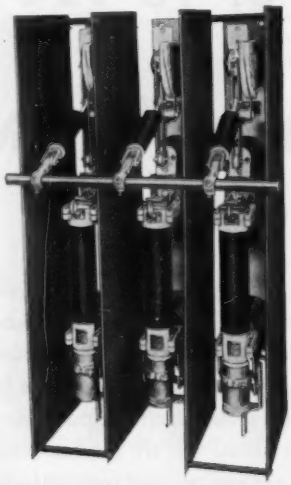
VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

R&IE POWER SWITCHING CENTERS



GOOD APPEARANCE—FEEDERS UNDERGROUND

Cost Less Save Space Easier to maintain



FUSED HPL-C INTERRUPTER SWITCHES

Ratings up to 14.4 Kv (110 BIL)
600 Amperes—(40,000 amps. momentary)
1200 Amperes—(60,000 amps. momentary)

HIGH VOLTAGE PSC CUBICLES, standard design—offer three-way economy for primary switching when space is limited, cost is a factor and where feeders are underground.

CONSERVE SPACE—Less area required than with open structure. Standard PSC cubicles mean space requirements can be accurately determined. Add a cubicle any time—up to 1200 amp. total load.

SAVE MONEY—R&IE fused interrupter switches, in PSC cubicles, provide a high quality of protection. High interrupting capacity at moderate cost.

REDUCE MAINTENANCE PROBLEMS—Easily operated; window front inspection; equipment accessible; universally-known power fuses. Can be handled by any factory or building maintenance crew.

Add safety with optional TOG-L SNAP operating mechanisms.

Ask your I-T-E Representative to show you the many economies of PSC cubicles.

R&IE

R&IE EQUIPMENT DIVISION
I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PA.

PSC - 4

POWERS *American* PRESENTS . . .

an aerial unit designed specifically for operations requiring only one workman

THE COMPLETELY NEW

Series AB-1-41

"Sky-Master"

HYDRAULIC AERIAL BEAM

FOR WORKING IN HARD-TO-REACH PLACES WITH GROUND-LEVEL EASE

Over • under • around obstacles . . . Sky-Master quickly reaches out-of-the-way work — and provides on-the-ground safety and comfort for the workman.

Independently-operated steel beams are moved by double-acting hydraulic cylinders, through a unique system of linkage which greatly increases operating range. There are no chains, sprockets, or other secondary means of actuation. Supporting mast can be rotated *continuously* in either direction.

Work basket and insulated outer beam protects workman from 60,000 volts. Basket is automatically locked in position in event of damage to hydraulic lines.

The AB-1-41 . . . having ground-to-basket floor height of 41' . . . can be equipped for your particular job, and installed on a Powers-American Body that fits your needs.

The heavy-duty Series AB-37 and AB-43 Sky-Master carries two men up, out, over, or down. Available in 37' and 43' ground-to-basket heights.

Descriptive literature on Series AB-1 and Series AB Sky-Master — with price information — will be sent on request.

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Following his "Law of Squares" in 1853 he perfected the curb transmitter, which overcame the retardation of signals in long-distance cables.

From Lord Kelvin's theory plus practice, more than a century ago, stem today's advances in communications.

For over a century, Kerite theory and practice has p. ved that Kerite is the most lasting cable known. More than three generations of Kerite craftsmen have given of their inherited skill to assure the long life and service of Kerite Cable. The Kerite Cable Company takes pride in the fact that their product is chosen by buyers of integrity to safeguard installations around the world.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

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THE KERITE COMPANY—30 Church St., New York 7, N. Y.
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EDITORIALS

1957: Consumer Sales Can Build A Boom

"If the nation's salesmen who cater to consumers were soon to start turning in a masterful performance, we might end up this year with a boom in consumer business which would be a worthy companion piece to the boom in capital goods business with which we ended up 1956."

This is the challenge that opened the latest report on business conditions prepared by the McGraw-Hill Department of Economics.

The facts behind it are simple, but they are telling. Consumers income has continued to rise steadily for the last six months or more. Personal income stands at an annual rate of $338 billion nationally, up $18.5 billion in the past year and up $11 billion in the last six months. And further gains seem certain because some 5 million workers will automatically get wage increases this year.

In spite of this there has been nothing to suggest a rush on the part of consumers to spend money freely. In fact, they seem to be sitting on it. The latest University of Michigan survey of consumer buying intentions shows people far less eager to buy than in 1955. Moreover the rate of saving is close to an all-time high. But before 1957 is over the amount of compulsory saving represented by payments on installment debt is scheduled to drop as people pay off their 1955 auto loans.

One conclusion stands out. Consumers will both receive and spend larger amounts of income, as 1957 wears on, provided salesmen meet the challenge that is uniquely theirs.

Certainly the 1957 consumer sales efforts of the electrical industry are off to a flying start. They are keyed to established, industry-wide promotions like Housepower, Live Better . . . Electrically and Electrical Week. And in the months ahead they face a selling climate that presents a unique promise of success.

Given the necessary backing the industry's campaigns have the capacity to become pace setters in a resurgent sales movement that can reach boom proportions this year.

Preparation: The Utility Role in Civil Defense

Preparation and planning are keys to the role of electric utilities in civil defense activities today. Getting this necessary task done is the obligation that each individual utility bears as a result of the nation's stark dependance on power for civilian survival and military action under attack.

The measure of the planning and preparation to be done by individual utilities was suggested by a series of questions posed recently by Assistant Secretary of Interior Fred G. Aandahl whose department is charged with responsibility for national defense for electric power.

Among his questions were these:

1. Are electric utilities prepared?

2. Are there adequate security plans for generating plants?

3. Are employees trained in radiation detection?

4. Do key employees have, not just mobilization points, but alternate reporting points?

5. Are supplies and equipment stored in widely scattered areas?

6. Is adequate protection provided for employees who must remain on duty?

7. Is there more than one emergency headquarters and dispatching point?

8. Is communication with neighboring systems feasible?

9. Has there been designated a line of succession for top executives?

10. Are delegations of authority provided so that subordinates may act?

11. Are duplicates of vital records in safe locations?

12. Has liaison been established with the local civil defense director?

13. Have utility civil defense plans been coordinated with the local civil defense director?

14. Are the plans coordinated with nearby utilities?

15. Are mutual aid pacts only with neighboring utilities?

These are the questions that each utility must answer for itself, in developing an emergency plan. But in the final analysis it is not the plan itself that is important, it is the fact that planning has been done that counts.

Cannon's Blast Sets Off Atom Battle in Congress

Democrats launch campaign to win Gore bill passage, Murray reappointment to AEC; GOP optimistic, plans defense tactics

Democrats in Congress, still rankling from defeat last year of the Gore federal reactor bill, have now set themselves in position to bargain for what they want from Congress and the Administration.

Their demands: (1) Adoption of the Gore bill in whole or part. It calls for a $400-million federal reactor construction program; (2) Reappointment of Atomic Energy Commissioner Thomas Murray whose term expires June 30. Murray is the last Democratic appointee on AEC.

Their weapons: (1) Refusal to approve AEC's appropriation requests; (2) Refusal to confirm any nominee by President Eisenhower for the AEC vacancy left by the death of Dr John Von Neumann; (3) Refusal to vote favorably on the Administration-desired federal insurance bill.

On the surface the Democrats appear to hold the aces. But Congress Republicans believe the odds favor them on the Gore bill, at least. They are counting on the economy-mindedness of Congress and enough opposition from coal-mining states to shave the Democratic majority.

Through Rep Clarence Cannon (D-Mo.), House Appropriations Committee chairman, the Democrats have a strong hold over AEC's purse strings. And Cannon last week spelled out how AEC is to be brought to heel.

His position is this: AEC must obtain specific authorization from Congress for every atomic power project it undertakes. To date it has acted in contravention of terms of the 1954 Atomic Energy Act in contributing financial help for civilian atomic power projects. Unless projects are authorized by the

WASHINGTON COMMENT

Congress Girds for Action on TVA Financing

V. CRAIG RICHTER,
Washington Correspondent

The move in Congress to pass some form of TVA bond financing bill this session picks up steam this week with hearings scheduled on two recently introduced measures.

The Senate Public Works Committee was planning this week to hear witnesses on a bill by Sen Robert S. Kerr (D-Okla.) and cosponsored by Democratic Sens Lister Hill and John Sparkman (both Ala.), Albert Gore and Estes Kefauver (both Tenn.), James O. Eastland and John Stennis (both Miss.). It will also hear Sen Sherman Cooper (R-Ky.) on his TVA bond financing measure. So far, only one day (April 30) has been scheduled for the hearings.

TVA bond financing, favored by the Administration, TVA, and Democrats, ended in a stalemate last year with none of the various measures coming out of committee.

Two major factors have blocked adoption of bond financing bills: Retaining Congressional and budgetary control over TVA's actions and legislatively limiting TVA's territorial growth. The Administration has favored both these courses, TVA supporters have opposed them.

This year's bills, and to date no bill reflects the Budget Bureau or Administration point of view, stack up as follows:

The Jones-Davis bill: This measure, introduced by Rep Robert E. Jones (D-Ala.) and Clifford Davis (D-Tenn.), is the same as last year's bill which stayed in the House Public Works Committee.

The bill authorizes TVA to sell bonds without limitation and to use the proceeds to build new power plants and transmission facilities. There is no specific geographic limitation placed on TVA's future.

The bill does not require that TVA issue the bonds subject to Treasury control although the Treasury may buy the bonds.

The Kerr bill: The measure has been altered slightly from the ver-

Joint Committee on Atomic Energy, further appropriations cannot be made.

At the same time, Cannon charges the AEC civilian atomic power program is practically nonexistent. Therefore the government must build power reactors, he says.

While Cannon's position is legalistic, involving interpretation of the 1954 act, he does have the parliamentary power to funds either within his own committee or on a so-called point of order on the House floor, where a rule from the chair would block an appropriations vote.

JCAE Action Can Aid Cannon

This is where JCAE's influence enters the picture. Democrats on JCAE this year have gone along with the conciliatory mood of Chairman Carl Durham (D-N. C.). Now, without appearing to indulge in the private versus public power fight that underlies the atomic power debate, they can move to give Cannon what he wants—an amendment to the 1954 act requiring AEC to seek specific authorization for every project it undertakes.

Democrats on JCAE have a further move planned. In authorizing specific projects—including many existing power reactor demonstration projects undertaken by private industry groups—they would throw in additional projects giving in effect part or all of the Gore bill.

Republicans on JCAE contend the move will not succeed. They maintain the AEC program is advancing rapidly enough and that there is insufficient justification to warrant expenditure of additional millions on federal reactor construction.

Although both sides seem to be far apart, this is the likeliest area for compromise: A JCAE-approved authorization bill permitting AEC to go ahead with its demonstration program but also requiring that it build a number of projects on its own to meet the Gore bill demands.

Murray Controversy Rages

The Murray reappointment introduces the complicating factor. JCAE Democrats strongly desire his reappointment because Murray is their best source of information on what AEC is doing. Without him, they fear, AEC Chairman Lewis L. Strauss will not keep them fully informed.

Republicans, on the other hand, consider Murray is responsible for much of the partisan fighting that has surrounded the atomic energy program the past two years.

Eisenhower said curtly it was his responsibility to appoint people to the executive department when questioned recently about a JCAE letter signed by 10 Democrats and Rep James Patterson (R-Conn.) endorsing Murray. Strauss is opposed to Murray's reappointment.

Compromise seems almost impossible—which means Murray probably won't be reappointed. But Eisenhower can wait until Congress adjourns and then make a recess appointment and so delay the fight over confirmation until next year.

Insurance Outcome Uncertain

The final major complicating segment of the atomic program picture is federal indemnity insurance. All sides approve of this bill, but this does not guarantee adoption.

The campaign lines have been drawn and the next move appears to be up to the Administration or the Republicans. But, as one JCAE member said, the atomic power program is more in need of statesmanship today than at any time in its history.

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sion introduced by Kerr last year. It differs from the Jones bill in two important respects.

Firstly, while it places no limitation on the amount to be raised by bond sale, it does require TVA to settle on the amount after consultation with the Treasury.

Secondly, it opens the way for Congressional control over TVA's expansion plans in that TVA must notify the President and Congress of construction plans. But if within 60 days there is no disapproving Congressional action, TVA can go ahead.

Both points are changes from last year's bill. Also new is the provision permitting Treasury to buy such bonds. But the bill still lacks geographical limitations.

The Cooper bill: Although Cooper contends his bill is not an Administration measure, it comes closest to reflecting the Administration viewpoint.

Cooper says the bill is the outcome of discussions with TVA, the Budget Bureau and Treasury and represents a compromise.

The measure puts a ceiling on the amount of money TVA can raise by bonds—$750 million to take care of expansion needs for five years—and calls for a geographical limitation. None of the bond proceeds could be used outside the TVA service area as of last February unless Congress decided otherwise.

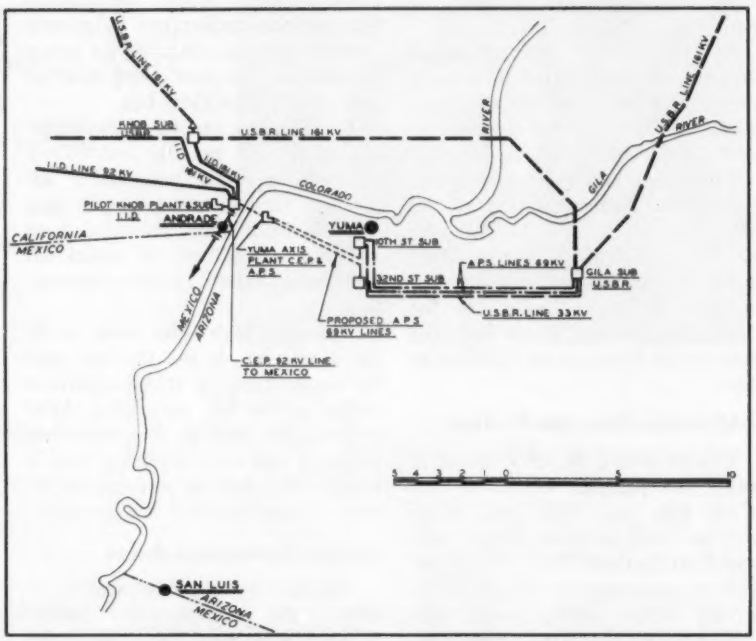
The Cooper measure would give TVA some freedom of action by permitting it to plan for five years at a time but retains Congressional control since TVA would have to come back for authorization of the next five-year program. All bond sales would be subject to consultation with Treasury.

So far the Budget Bureau has given no indication of where it stands on the various bills. Insiders report that absence of any Administration measure this year reflects some disagreement among Administration officials as to just what they do want.

In his budget message to Congress this year, President Eisenhower urged adoption of bond financing legislation. After adoption, he said, TVA's power needs could be re-examined but meanwhile Congress should authorize $30 million for a new 180,000-kw steam plant addition. This week's hearings should do much to reveal how the bond financing fight will shape up this year.

Power Pool Spans Mexican Border

Arizona PS, Calectric, and Imperial Irrigation District sign pacts. New 160-Mw plant to be owned jointly by APS and Calectric



ARIZONA PS, CALECTRIC will build lines to link Yuma plant to existing grid. Much of Calectric's energy allotment will be passed to its Mexican subsidiary

More power for the area where Arizona, California, and Mexico come together is assured through generation and pooling agreements signed recently by three utilities.

The plan's outstanding feature is joint construction of a 160-Mw steam plant by Arizona Public Service Co, and California Electric Power Co (EW, Dec. 31, 1956, p 51). A third utility, Imperial Irrigation District, will share in the ultimate power pool through purchase and wheeling of power.

The Bureau of Reclamation's Parker-Davis system will participate also by transmitting power. Interconnection of the proposed steam plant with the Parker-Davis system will strengthen the transmission grid serving the two-nation, two-state area.

New Lines Proposed

The new agreements provide plans for construction of new generation and transmission tie lines and for assignment of generation and transmission costs.

The first pact, known as the Axis Agreement, between Arizona PS and Calectric, provides for construction of a mutually owned 160-Mw steam plant on an 80-acre tract near Yuma, Ariz. It will have two 80-Mw units and provisions for a third unit. Calectric has scheduled the first unit for completion in 1959. Arizona PS will build the second by 1962, and will operate both units.

Yuma Site Jointly Owned

The land will be divided into two tracts separated by an axis line, with each company owning about equal acreage. The companies also will share costs. This part of the pooling agreement will be administered by an "axis" committee of two members from each company.

Primary facilities on the tract are to be owned by the individual companies. Certain "common" facilities are to be used by both. Equal investment by each company are to cover these facilities, with mutual easements granted one to the other.

'Coordination Pact' Signed

Cooperation in the expansion and operation of the three utilities' systems is outlined in a second pact, called the Coordination Agreement. Transmission lines will be provided —in relation to existing facilities either owned by one of the utilities or the Bureau—so as to facilitate the pooling plan.

As an initial step, Arizona PS proposes to build two 6-mi, 69-kv lines from the plant site to Yuma substations. These lines will provide a tie to the Bureau's system south of Yuma over which power will be transmitted to Calectric's system in the San Luis, Mexico, area.

A ¾-mi, 161-kv tie will be built by Calectric from the plant in Arizona to Imperial Irrigation's Pilot Knob substation across the Colorado River in California. This will provide a second tie-line to Imperial Irrigation's 161-kv line to El Centro, Calif. The existing tie consists of 33-kv and 161-kv lines operated by the Bureau. Over one or both of these ties, power can be transmitted to Imperial Irrigation's system in Imperial Valley and to Calectric's system in and south of Mexicali, Mexico.

Operating Advantages Gained

The Coordination Agreement also provides the usual pooling advantages of coordinated load dispatching, scheduled power deliveries, and spinning reserves. Existing operating agreements between the utilities will be strengthened in matters of economy and emergency assistance.

A coordinating committee of one member from each organization will administer the overall agreement.

Power allocations of the Yuma Axis plant are to be worked out yearly. Much of Calectric's allotment will be fed to its Mexican subsidiary (which grew 19% last year). A table of percentages will be worked up each year by the operating committee. Should more capacity be required a new agreement must be made.

Outlook for Business: High Spending

In 1957, electric and gas utilities will increase capital outlays 22%—a $6-billion sum. Average outlay for 1958 to 1960 will be about $5.4 billion per year for utilities

A $150-billion capital expenditure program is contemplated by all business in the next four years. So reported McGraw-Hill's Dept of Economics in releasing its tenth annual survey of U. S. business' plans for new plants and equipment in the 1957-60 period last week. This compares with $124 billion spent by all business in the four-year period of 1953-1956.

All business is expected to spend almost $41 billion in 1957, or 12% more than 1956. This compares with 11% in the preliminary check-up last fall (EW, Dec. 17, 1956, p 16). For 1958 to 1960 business firms are expecting to spend another $110 billion, or an average of $36.4 billion a year.

Utilities to Spend $6-Billion

Electric and gas utilities' plans are also on the increase. They will hit nearly $6 billion in 1957, or an increase of 22%. This is nearly 15% of the total to be spent for all business in this year. For the next three years (1958-1960) these utilities are slated to spend over $16.2 billion, or an average of $5.4 billion a year.

As can be seen from the table, the average level of spending for all business already planned for 1958 to 1960 is close to the actual spending in 1956. It can be safe to assume that such spending will actually continue above the 1956 level during most of this period.

Economic Strong Spots

Strong spots in capital expenditures can be found in the machinery and electrical machinery firms, the oil industry, utilities, and "other transportation and communications."

Machinery industry is slated to spend around $1 billion for each of the next four years.

Electrical machinery industry plans an 18% increase in 1957 to a little over $712 million. It will level out in 1958 and 1959 around $700 million and then shoot up again in 1960 to $762 million. This is one of the best examples of really long-range planning, the report stated.

Close to 20% of the 1960 sales in the machinery and electrical machinery industries will be in products not made in 1956. This will mean, the report said, "the introduction not only of new machines, but of many completely new processes during the next four years."

New Products Coming

The survey also pointed out that the number of firms investing to make new products in the electrical machinery industry has jumped from 44% to 65%.

Petroleum industry has slated an expenditure of nearly $6.2 billion in 1957, up 11% over 1956. It should hit a record $6.4 billion in 1958, sliding off to $6.3 billion in 1959 and $6.1 billion in 1960.

Electric and gas utilities' spending will total over $22 billion for the four-year period, or an average of $5.5 billion a year.

Power Companies Up 26%

Advance plans for power companies alone will show a 26% increase over 1956, the report said. This survey was made in March and April, when money rates were high, and helps confirm the fact that these companies are still planning to add facilities at a record rate. Electrical World's survey of last December published Jan. 28 showed a $3.8-billion expenditure in 1957 for electric companies only, an increase of 31% over 1956.

A sharp rise in expected deliveries of merchant ships and jet airliners helps increase the spending plans of "other transportation" companies not only in 1957 but in the 1958-60 period. This accounts for the rise

Capital Spending Surges Ahead, with Four Exceptions

Industry	Capital Expenditures—Millions of Dollars 1956*	1957*	% Change	1958*	1959*	1960*
Iron & Steel	$1,336	$1,897	42	$1,328	$1,102	$992
Nonferrous Metals	601	998	66	609	353	293
Machinery	1,078	1,133	5	975	940	938
Elec. Machinery	603	712	18	705	712	762
Autos, Trucks, Parts	1,689	1,199	−29	803	803	803
Transportation Equip	460	686	56	638	415	369
Other Metalworking	887	928	5	844	834	854
Chemicals	1,455	1,906	31	1,849	1,720	1,651
Paper & Pulp	801	985	23	887	692	692
Rubber	201	217	8	228	242	223
Stone, Clay & Glass	686	633	−8	508	493	455
Petroleum Refining	711	924	30	979	910	746
Food & Beverages	799	913	14	795	754	736
Textiles	465	399	−14	317	327	331
Misc. Manufacturing	1,035	1,012	−2	925	760	756
ALL MANUFACTURING	12,787	14,542	14	12,390	11,057	10,601
Business						
Petroleum Industry	5,531	6,166	11	6,421	6,276	6,081
Mining	443	474	7	372	353	299
Railroads	1,231	1,366	11	1,188	1,129	1,152
Other Trans. & Commun.	4,229	4,963	17	5,060	5,590	5,950
Elec. & Gas Utilities [1]	4,895	5,991	22	5,880	5,238	5,113
Commercial	8,236	8,401	2	8,065	7,178	6,317
ALL BUSINESS [2]	36,641	40,979	12	38,397	35,911	34,767

* 1956: Actual expenditures. 1957: Planned. 1958–59–60: Preliminary plans. Sources for 1956: U. S. Dept. of Commerce, Securities & Exchange Commission, McGraw-Hill Dept. of Economics.

[1] Gas utilities based on survey by American Gas Assoc., 1957–60.

[2] Petroleum refining, included under both manufacturing and petroleum industry, counted only once in the total.

in total spending plans of the "other transportation and communications" group, the report pointed out, although trucking firms expect some decline and communications companies foresee relatively steady outlays.

Eyeing 1957 expenditures there are four weak spots. The most important is the automobile industry, including trucks and parts. A 29% drop is expected this year as compared with a 20% drop shown in the December survey. In 1958 the expenditures for these companies will fall off again to less than half of the 1956 level. Automobile companies have reported that after 1958 no changes in spending either way have yet been decided on.

The next industry to show a weakness is textiles. It will show a 14% decline in 1957 but is planning a steady level of expenditures in the 1958-60 period.

Stone, clay, and glass and miscellaneous manufacturing industries are the other two showing less expenditures in 1957 than 1956 and continue to decline through 1960.

Engineers, Scientists Needed

More engineers and scientists will be needed to take care of the increased spending in research and developement.

The manufacturing industry estimated that it will need to employ 7% more scientists and engineers in 1957. By 1960 it is expected to employ an additional 15%.

The largest increase in scientific and engineering employment for the 1957-60 period is expected in the petroleum field with 33%, followed by the steel and machinery industries with 32%, and electrical machinery with 29%, the report said.

These figures are large, the report stated, and "employment objectives in research and development obviously will require a continuing high number of scientific and engineering graduates. But if the number of these graduates continue to increase, it should be possible to carry out the research as planned."

ATOMIC PROGRESS

Army's Package Reactor Ready for Service

Is first power reactor using stainless steel fuel cladding

The 2,035-kw Army Package Power Reactor, producing test power since April 15, is to be dedicated April 29 at Ft. Belvoir, Va.

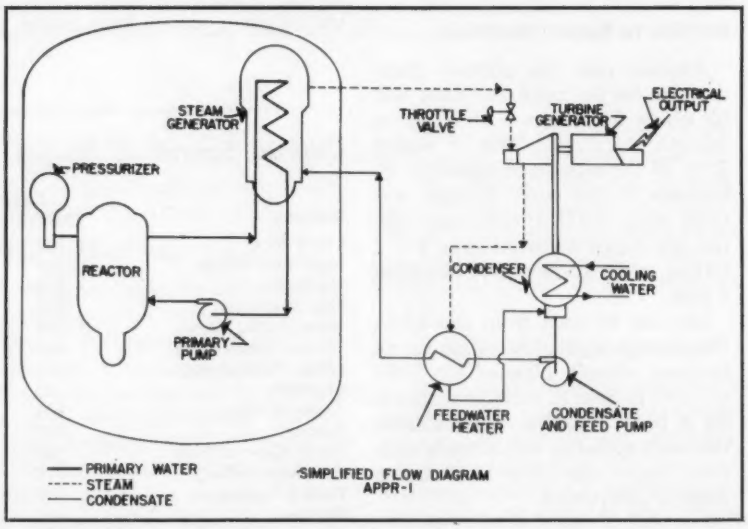
Built by ALCO Products, Inc, the APPR's net electrical output of 1,855 kw will be fed into the Ft. Belvoir power distribution system. The remaining 180 kw will go to plant auxiliaries.

The APPR is the first pressurized-water nuclear reactor to clad its 38 fully enriched uranium fuel elements in stainless steel, using light water as the coolant and moderator.

The main components of the APPR primary system are: Reactor vessel and core, seven control rods and drives, two coolant circulating pumps, piping, steam generator, pressurizer, water purification equipment, and shielding.

Cooling water enters the reactor vessel at 431F under 1,200 psi to prevent boiling. While circulating upward between fuel plates at 4,000 gpm, it is heated to 450F before passing to the steam generator.

Here heat from the high-pressure primary water is transferred to water in the secondary system, thus producing steam for the turbine.



ARMY'S PACKAGE NUCLEAR reactor will produce 2,035 kw, of which 180 kw goes to auxiliaries at Ft. Belvoir site. Fully enriched uranium used as fuel

NUCLEAR NOTES

Atomic fuel elements are to be produced soon at two new manufacturing centers. The first is a $500,000 General Electric Co plant now being built at San Jose, Calif. The second is a 25,000-sq ft plant to be built at Hicksville, N. Y., for Sylvania-Corning Nuclear Corp.

Reactor cost has doubled for Consumers Public Power District, Columbus, Neb. Current reactor figure is $26.6 million, bringing project total to $38.6 million. Fuel fabrication will run $631,000; electric plant, $8.7 million; supporting facilities, $2.6 million.

R/W Meeting Set

Chicago is the locale; how to lick annoying problems is the subject . . .

What can the right-of-way man do about zoning, land titles, new highways, and property owners that hamper electric utility companies' expansion? How can he best plan for a future that portends higher transmission voltages with less overhead and underground space, inflated real estate values, and a shortage of competent R/W employees?

These and other questions will provide the taking-off points for discussions at a Right-of-Way Meeting in Chicago, Ill., May 15, being sponsored by Electrical World.

Directors and managers of real estate, R/W, and engineering operations will explore today's problems and the outlook for the future in four panel discussions. Topics are "Finding and Training R/W 'Salesmen'"; "R/W Problems of Tomorrow"; "An Appraisal of Appraising"; and "Public Relations." Talks will be followed by question-and-answer sessions.

The one-day conference will be held at the Conrad Hilton Hotel. It precedes the American Right of Way Association's annual seminar, May 16-17, which also takes place at the Conrad Hilton.

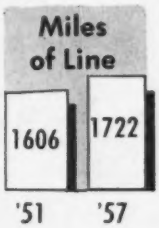
Registration is $12 for the Electrical World meeting. This includes luncheon, social hour, and a copy of proceedings. For registration reservations write R/W Editor, Electrical World, 330 W. 42nd St., New York 36, N. Y. Room reservations should be arranged with the hotel.

FPC Grants Hydro Permit

Federal Power Commission has granted a preliminary permit to Public Service Co of Indiana for a proposed hydroelectric generating station on the Ohio River, on the Indiana side of the proposed Markland Dam to be built by Army engineers. The proposed project would include four generating units rated at 20,000 kw each.

Drought Hits a Texas Co-op...

. . . causing loss of customers, rise in number of empty meter sockets. Yet revenue edges up



Travel 150 miles or so northwest of Austin and you come to the once rich agricultural county of McCulloch, Texas. There is a little more greenery there this Spring than there has been for seven years, but the ravages of the long drought are still apparent in the fallow fields and the abandoned farm houses.

For electric utility men, there is the occasional pathetic sight of gaping meter sockets out on the farm yard pole. Dust covers the front porch.

In the town of Brady, which is near the center of the county, stands the headquarters of the McCulloch County Electric Cooperative, Inc. There, Manager B. C. Broad sketches in some of the background:

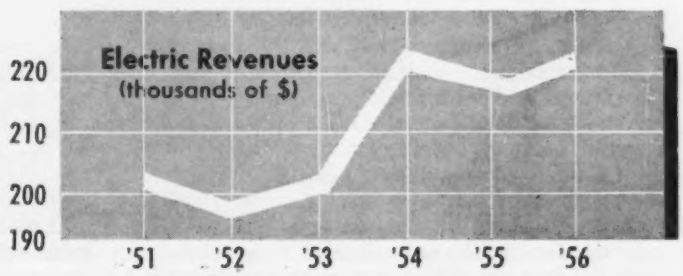
"This area is going through the worst drought in its history. We have been in this for a seven-year period and we do not see the end.

"Our cooperative here and the Kimble Electric Cooperative at Junction are the hardest hit. Other co-ops in this area have been hard hit from their lagging farm load, but they have sufficient oil pumping load to show increases in kwhr sales. Other small utilities in this area have lost a large number of customers and their kwhr sales have dwindled."

Broad thumbed through his records to show the effect of the drought on his business (charts at left and bottom). The co-op has lost a net of 466 customers over the past seven years. During this period, it has added slightly over 100 miles of lines. And the number of abandoned farms —or empty meter sockets as it shows up in his records—has risen from 125 to 703 during the 1951 to 1957 period.

Yet because of the increased irrigation pump loads, the addition of chicken houses, and the additional pumps for stock watering, McCulloch County Electric Co-op has still been able to increase its sales and its revenues during all but the driest years.

In general, counties like McCulloch and Kimble are isolated cases as far as utility operations are concerned. Other areas are faring better.



People, Wires, & Laws

Here are several news stories reported recently to Electrical World:

TALLAHASSEE, Fla.—A "safety bill," backed by Florida Power & Light Co, was killed recently in the state's House of Representatives by a vote of 43 to 39. The bill would have made it a law violation for anyone to come within 6 ft of a high tension line. Opponents pounced on it. They said the bill would have made it virtually impossible for damages to be recovered by a person killed or maimed by wires.

OMAHA, Neb.—A 52-year-old Omaha junk dealer told police that 17-year-old Donald Marfisi was accidentally electrocuted while the two were attempting to steal wire from power lines. The junk dealer, Otto Glaser, was quoted as saying he sent the boy up a pole with a pair of wire cutters. As he saw the youth start to cut the wrong wire, he shouted, "Donnie, Donnie, don't do it." There was a flash of flame. He panicked, loaded the boy's body and his severed hand into a truck, dumped it off at what he thought was a hospital entrance. The entrance was to an institution for the aged and chronically ill.

PITTSBURGH, Pa.—A Northside man sought to retrieve a kite entangled in the wires of a utility pole for neighborhood boys. He climbed up, grabbed the kite, lost his balance, fell, died of a fractured skull and internal injuries.

KEYSTONE, W. Va.—Appalachian Electric Power Co's Keystone service crew found a pole cut down and 110 lb of copper wire stolen from the secondary. Next day police caught the culprit —a teen-age boy. The boy said he was knocked out when he touched a hot line after cutting down the pole. He regained consciousness, however, and took the wire in hopes of improving his financial status.

West Penn Washes a Boiler

West Penn Power Co has used a potassium silicate wash, developed by Chief Chemist Michael D. Baker, to clean out No. 1 boiler at its Mitchell Power Station. The utility reports that this resulted in a faster, less-expensive job, and left the metal inner surfaces more resistant to corrosion than a conventional acid wash would have done.

Although utilities generally make every effort to keep silica out of boilers because it forms crusts on turbine blades, cutting generating efficiency, West Penn used 70 times as much silica as allowed. But the silica acted as a detergent, and worked loose the dirt clinging to the insides of the tubes.

During the wash, a laboratory technician analyzed water samples to check progress. When the samples came out clean, the washing stage ended. The boiler was inspected, flushed of remaining loose dirt, rinsed several times, blown down, then restored to service.

Here's the 'Hole Story'

Ever since Puget Sound Power & Light Co of Seattle converted to centralized punch-card billing a year ago, customers have been stumping the personnel in its 31 branch offices by asking what the holes meant in their bills. The utility wanted to explain to its personnel the story behind each hole.

A movie film was the vehicle selected for doing this. A few scenes were shot each day for about a month by a commercial film company. All parts were played by Puget Power employees. Cost of the 35-min. film: Less than $1,000.

The picture is broken into three sections dealing with (1) customer service order procedure, (2) meter reading and customer billing, and (3) cash handling procedure. The film is stopped after each section, and questions are invited. If desirable, that section is then repeated.

Jobs Reclassified . . .

After nearly three years of negotiations, the Society of Ontario Hydro Professional Engineers and the Hydro-Electric Power Commission of Ontario succeeded in working out a reclassification of professional engineering jobs, made effective last December. A recent report from Toronto says "dissatisfaction is rife among many of Ontario Hydro's 1,000 professional engineers" as a result. Many engineers have found themselves in lower classifications than before. Although no wages were cut, the outlook for raises appears bleak because the engineers' present salaries are "far beyond" the amount called for under the new classification.

Spring Peak in Dayton

April 8 in Dayton, Ohio, was like many another spring day—partly cloudy, coolish, and with a bit of wind. It was a Monday and "spring fever" seemed a little more apparent than usual.

Dayton Power & Light Co officials were startled, therefore, to discover that their two generating plants were reacting to a new demand peak of 541,000 kw—about 3,000 kw above the previous winter peak. The utility customarily hits weekly peaks on Tuesday or Wednesday, and yearly peaks in December. The proferred explanation: Local industrial loads must have zoomed up faster than expected.

Trial Run for New Meter Course

- **Polyphase metering theory and application is covered**
- **Forty-hour course is tailored to meet utility needs.**

Material for formal training in polyphase metering has been prepared by General Electric Co and trial runs of the course were made in Minneapolis, Milwaukee and Chicago on March 20, 21 and 22. The trial runs were brief, just long enough to give experienced meter men information on what would be covered in the real course and to get their reactions to the program so that changes could be made before final material was sent to the printer. In Chicago 10 utility meter men from three companies, Commonwealth Edison Co, Northern Indiana Public Service Co and Central Illinois Electric & Gas Co attended the preview.

The polyphase meter course is patterned after the single phase meter course that was presented two years ago. It is designed to teach theory and application of polyphase metering and to give the men an understanding of the why of things.

Course Is Complex

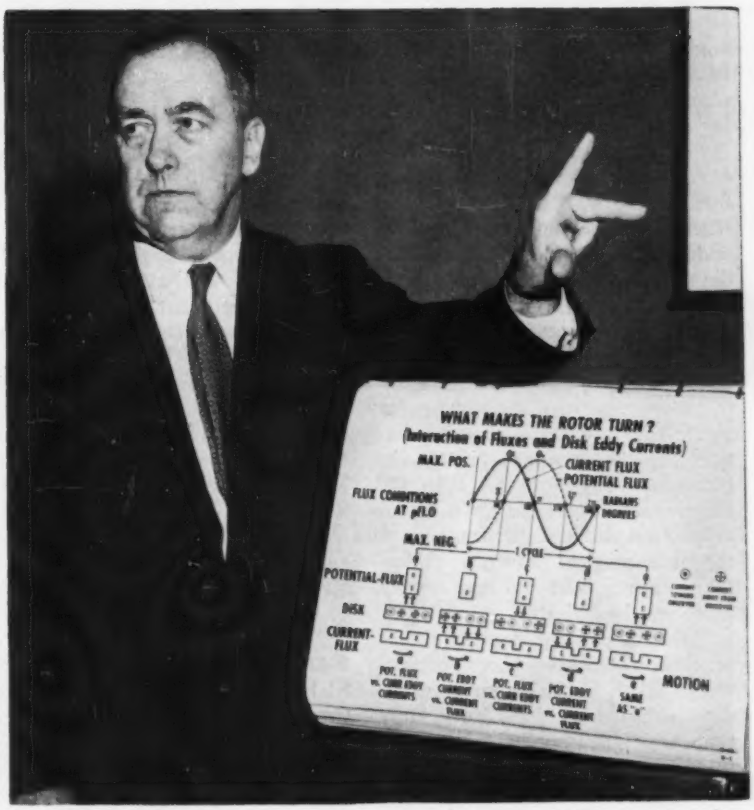
The polyphase course is long and complex. It is planned for presentation in 40 hours and the schedule can be arranged to fit the convenience of the utility. It can be scheduled for five days, all in one week. Or, it can be scheduled one day a week for five weeks. Or, it can be shortened if that seems desirable.

The course is divided into six sections:

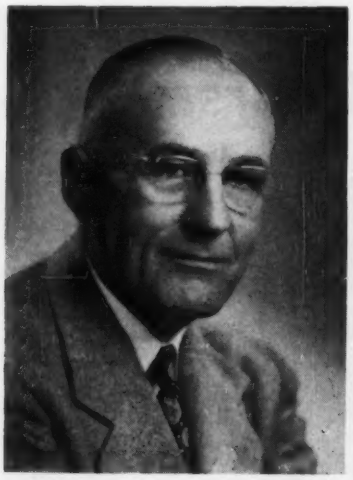
1. Background and history
2. Principles of electricity
3. Watthour meter components and their functions
4. Polyphase meter selection and application
5. Inspection, testing and maintenance
6. Polyphase kilovar metering

The course will be available about the middle of May.

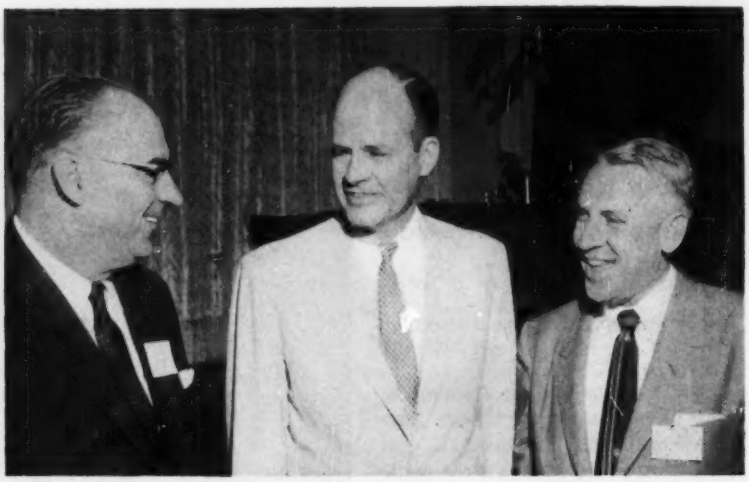
CHICAGO PREVIEW OF METER COURSE is conducted by N. I. Saven, meter specialist, General Electric Co. Meter men from three utilities participated in trial



FLIP CHART IS USED to show what makes rotor turn. H. F. Crotty, GE applications engineer and author of the course, was one of the instructors at the trial run



L. M. SMITH, Alabama Power Co president, was elected new SEE president



G. S. DINWIDDIE (center), New Orleans Public Service, is retiring SEE president. With him are A. C. Monteith, Westinghouse (left), D. S. Kennedy, EEI president

SEE Told Reactors Must Boost Efficiency

Boca Raton meeting hears conversion is only 0.33% of nuclear fuel, and true cost of nuclear power generation is still sheer conjecture

The conversion efficiency of reactors must be increased by future nuclear power technical development, the Southeastern Electric Exchange was told at its annual meeting April 1-3 at Boca Raton, Fla.

Present conversion is only a third of 1% of the energy in uranium fuel, said Dr. W. J. Zinn, General Nuclear Engineering Corp. This, he added, amounts to about 3,000-Mw days per ton of uranium, or 20 million kwhr per ton.

Greater conversion efficiency, said Zinn, will be difficult to obtain, as fuel burns unevenly in the reactor, more rapidly at the center than at the edges. Corrosion and radiation, he said, do not permit leaving the outer rods in longer than the center ones. The need for a prototype, Zinn declared, depends upon the technological advance undertaken. For a bold and new step, a prototype is advisable.

The true cost of nuclear power generation remains sheer conjecture, said J. F. Fairman, Consolidated Edison Co of New York. Only time and operating experience, he said, will bring out the true costs and indicate the hours a reactor can be operated. The paucity of knowledge about the cost of reprocessing waste obscures the general cost picture.

Partnership between government and industry will accelerate the national nuclear power program, declared Maj Gen Kenneth D. Nichols, U. S. A. retired. Government should do the research and development, assuming their costs, and industry should build power reactors, including prototypes. Expansion of this partnership will avoid monopoly. Nichols urged that the government lower or waive the use charge on fuel.

Rate of return on company investment must be kept up to attract and keep investors, said John Childs, Irving Trust Co. He advised utilities to add young men to their financial staffs, and to work closer with regulating bodies, even to the extent of trying to get better salaries for their staffs.

Cites Preference Survey

D. S. Kennedy, president of the EEI and Oklahoma Gas & Electric Co, cited a survey showing that only 6% of the public favored the preference clause. He urged the industry to get the facts to the public through supporting EEI, PIP, ECAP, and NAEC, and to enlist the aid of the ladies. Women, he said, should be told how money is taken from the house budget and, in effect, given to others.

Newspaper editors will disseminate the facts brought to their attention through good press relations, declared D. I. Rogers, The New York Herald-Tribune. He urged that the industry appoint a spokesman other than the EEI president who, although a top man in the industry, doesn't speak for all. Citing an instance of press relations failure, Rogers said that if there was anything good to be said about the Dixon-Yates deal, it was not brought to the editors' attention.

The industry must continuously proclaim its faith in the free enterprise system if it hopes to see that system preserved, said D. S. Russell, University of South Carolina.

Well designed sales programs and rates can balance load throughout the year, said P. D. Brooks, American Gas & Electric Service Corp. They can also minimize the apparent conflict between a utility's desire to serve all loads on demand and earning an adequate return on investment.

Studies of AG&E system, where annual load factor is about 70%,

show that designed promotions and rates encourage the following loads: Space heating by heat pumps and resistance units for all classes of customers; high-diversity applications, such as water heating, cooking, and clothes drying; high-load-factor industrial loads; off-peak commercial and industrial loads; and interruptible power for certain industrial uses.

Sees Kwhr in Trillions

A. C. Monteith, Westinghouse Electric Corp, predicted that total electrical energy sales will reach 1.03 trillion kwhr in 1963. Industrial sales, he said, will go to 450 billion and residential sales to 271 billion kwhr, increases of 12½ and 15%, respectively, over his company's 1954 projections.

But such growth, he said, won't just happen. To obtain it, sales staffs must "run scared," technical advances must be made, and utilities and manufacturers must cooperate in a creative sales job in the industrial power field.

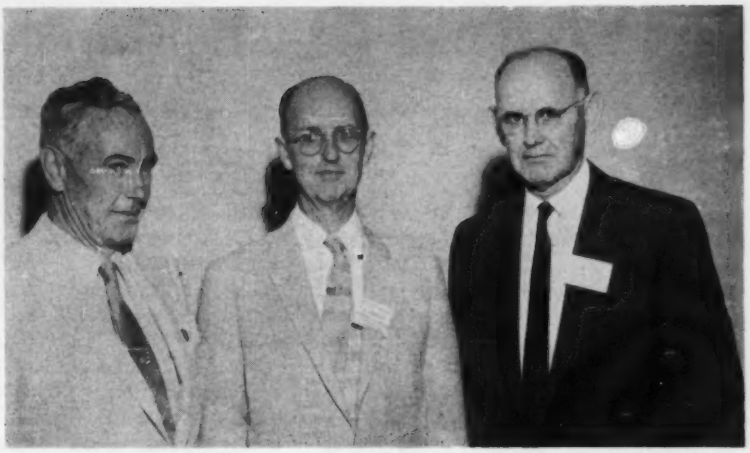
Ordering equipment must have a more regular pattern, said G. B. Warren, General Electric Co, indicating that kw capacity orders for consecutive years often differed as much as 100%.

Warren said also that 5 to 10% of future generating capacity should probably be some special lower-cost, peak-load unit. A prime mover ideally suited for this service is the gas turbine. Not only is its first cost lower, but sizes up to 30 Mw may be started and fully loaded in about 20 min in automatic stations.

Urges Research Group

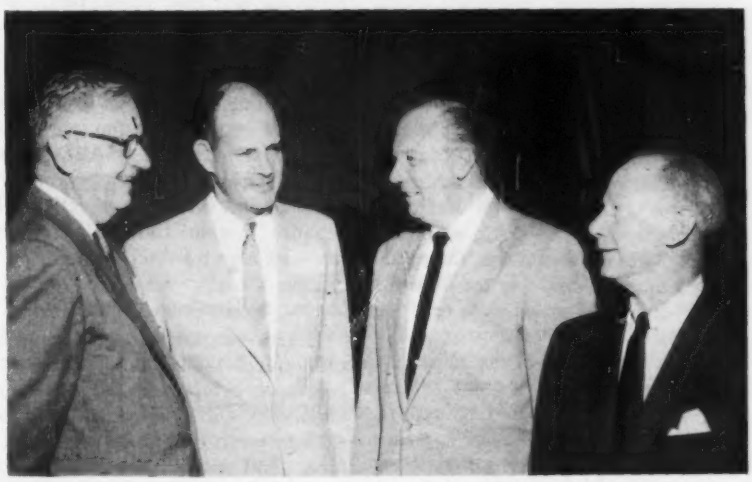
Formation of a SEE research committee was recommended by George S. Dinwiddie, president of SEE and New Orleans Public Service, Inc. The new committee would consist of three subcommittees delving into physical science, methods and operations, and economic and social problems. Besides making its own studies, Dinwiddie said, the committee should engage outside research organizations.

Establishment of the Southern Electric Generating Co, which will build a 1,000-Mw plant in the Alabama coal fields, will benefit Alabama Power and Georgia Power Companies, said J. F. Crist of the Southern Co.



VICE PRESIDENTS elected are (left to right) W. C. MacInnes, Tampa Electric; F. H. Coughlin, Central Louisiana Electric; and G. L. Furr, Appalachian Electric Power

NUCLEAR PANEL comprised (usual order) J. F. Fairman, Con Edison; E. H. Dixon, Middle South Utilities; K. D. Nichols; W. H. Zinn, General Nuclear Engineering



NEW SEE PRESIDENT DINWIDDIE is shown with J. W. Talley, SEE executive director; D. I. Rogers, New York Herald-Tribune, and J. F. Crist, Southern Co, speakers

MVEA Told Crash Plan Is Ruse

Kansas City meeting warned public power devotees would use A-plant program as foot in door of power business

Nuclear power development means for U. S. utilities only an assured future fuel supply, the Missouri Valley Electric Association was told at its April 3-5 Engineering Conference at Kansas City.

There is no reason for a crash program, and further development will not improve service, said J. Robert Welsh, president of both MVEA and Southwestern Gas & Electric Co. Public power advocates, he said, see nuclear power development as an opportunity to get into the power business.

Besides disposal of radio-active wastes, development is beset by costs higher than estimates, he said, pointing out that Shippingport Plant of Duquesne Light Co will cost $55 million rather than the originally estimated $37½ million. It will take lots of experimentation to reduce nuclear power costs to a level competitive with conventional-fuel power. Besides, there is no real need for it here for 15 to 20 years.

It is unfortunate that nuclear power plants came after the atomic bomb, said R. C. Allen, Allis-Chalmers Mfg Co, as there is no reason why such plants can't be built as safe as steam plants.

Jobs Should Be Challenge

Three factors combine to make opportunities for engineers, said H. W. Gouldthorpe, General Electric Co. These are: 1. Upsurge in population and the opportunity to supply their needs and wants, 2. International climate, 3. The need to make better uses of the forces and materials of nature. Gouldthorpe estimated the needs for scientists and engineers to be far in excess of supply. He suggested that the needs be documented and that the industry keep schools informed as to the type it requires.

After engineers get into industry, said Gouldthorpe, jobs not requiring such training should be pruned out to provide a challenge to other groups. After being freed of those jobs, the engineer should be assured of a proper challenge for his ability.

S. C. Killian, Delta-Star Electric Division, H. K. Porter Co, described a high-voltage vacuum switch which interrupts current through a series of vacuum switches. Circuit voltage determines the number of vacuums in series, one for 15 kv and five for 138 kv. Life expectancy depends upon currents interrupted. Tests indicate a life expectancy of 10,000 operations at 50 amp.

Several installations of fiber glass poles were reported by M. V. Swan, Line Material Co. Some locations were selected for their severe service conditions, and performance has been very satisfactory. Pole extensions, in 5-ft increments, have been developed, which will save the cost of replacements when higher poles are required or the pole top has been damaged. A tripod type of fiber glass transmission structure has also been developed. On present production equipment 11-in., 50-ft poles can be made. Pole diameters are expected to go to 18 in.

Parallel operation of LTC transformers involves keeping units in step to prevent or limit circulating current, said W. C. Sealey, Allis-Chalmers. He suggested ways of accomplishing the desired results: Manual control, reversed reactance compensation, cross current compensation, current balance, electrical interlock and mechanical ties. Best practice, he said, is the simplest method giving the desired operating characteristics.

Lightning arrester application has a direct bearing on the perfected power system, said E. J. Allen, General Electric. It is tougher on arresters today to do an effective job because system transients require frequent arrester discharge.

Larger Substations Economical

Large substations prove more economical than smaller ones, according to a report by J. K. Lawley, Oklahoma Gas & Electric Co. Substations were of the 66-kv/12.5-kv type, and sizes considered were 12.5, 25, 50, and 75 Mva. Three-phase LTC transformers were used.

Single-phase supply is more economical than 3-phase for present residential load densities, said E. B. McBurney, Kansas City Power & Light Co. His statement was based on studies of secondary design to meet a diversified demand of 1.25 kva per customer plus air conditioning load from 4 to 25% and for saturation of 25, 50 and 100%. Lighting and power secondaries are separated so that 3-phase service requires 5-wire secondaries.

Urges Planned Var Supply

System var supply should be planned as carefully as system watt supply, said V. J. Farmer, Union Electric Co. Calculations indicate that power factor correction to 97.5% is economically justified. Best relationship between benefits and costs is obtained with primary capacitors, fixed and switched, on the feeder. Method of correction should be based on relationship between costs and benefits, going in successive steps from primary to distribution substation, to bulk customer, to bulk substation, and to the generator for correction.

Accounting machines effectively determine rural feeder loads and substation loads as well as distribution transformer loads, said R. E. Veley, Iowa Electric Light & Power Co. Customer kwhr information is the basis for calculating loads.

Reporting ten companies' experiences with aerial cable, P. J. Handley, Missouri Public Service Co, noted that:

1. Aerial cable solves certain problems with trees, circuit congestion and appearance, and may defer need for underground facilities.
2. Some installation problems have been experienced, particularly on a company's first job.
3. Cable needs lightning protection.
4. Care must be taken to avoid cable injury during installation.
5. Standardized color coding of cable is desirable.

Problems of space, cost, and old types of equipment in the underground system can be met with new ideas and types of equipment, said I. L. Wilson, Oklahoma Gas & Electric Co. Some solutions of OG&E, said Wilson, include: serv-

J. ROBERT WELSH, president, addresses Missouri Valley Electric Association at opening session of its meeting that also heard F. E. McDonald, center, session general chairman, along with H. W. Gouldthorpe of General Electric Co

ing large new loads at 265/460 v, low-voltage-drop buses in vaults, new protectors for old transformers, and ring bus in manholes to balance load and save space.

Used More Abroad

Test results on tubular aluminum sheath cables were reported by E. J. Merrill, Phelps Dodge Copper Products Corp. Applications have been more extensive in England and Germany than here and in Canada. For satisfactory sheath life manhole conditions should prevent sheath strains in excess of 0.3%. Wiped joints should be protected from corrosion and sheath strain of joints should not exceed 0.1%. Massive wiped joints should be used. Wiped joint repairs are readily made.

Oklahoma Gas & Electric Co has made several changes in practices to reduce cable failures and improve service to customers served from vaults fed from the overhead system by underground cable dips, said H. E. Carpenter. The new practices call for annual test of primary cables, keeping spare cables available for by-passing failed underground cable, identifying service cables at each end, indicating phase rotation of customer's service at the main line switch, and having data to facilitate servicing equipment.

Tomorrow's relaying will require more speed and sensitivity coupled with better reliability, because of larger loads, larger sizes of all system equipment, and the higher investment per component, said J. G. Boyd and R. L. Watt, Southwestern Gas & Electric Co. It remains questionable whether dropping a load unnecessarily is safer than to avoid risk of damage to equipment. The problem will become more difficult as loads become larger and equipment more expensive.

Cuts Accidents

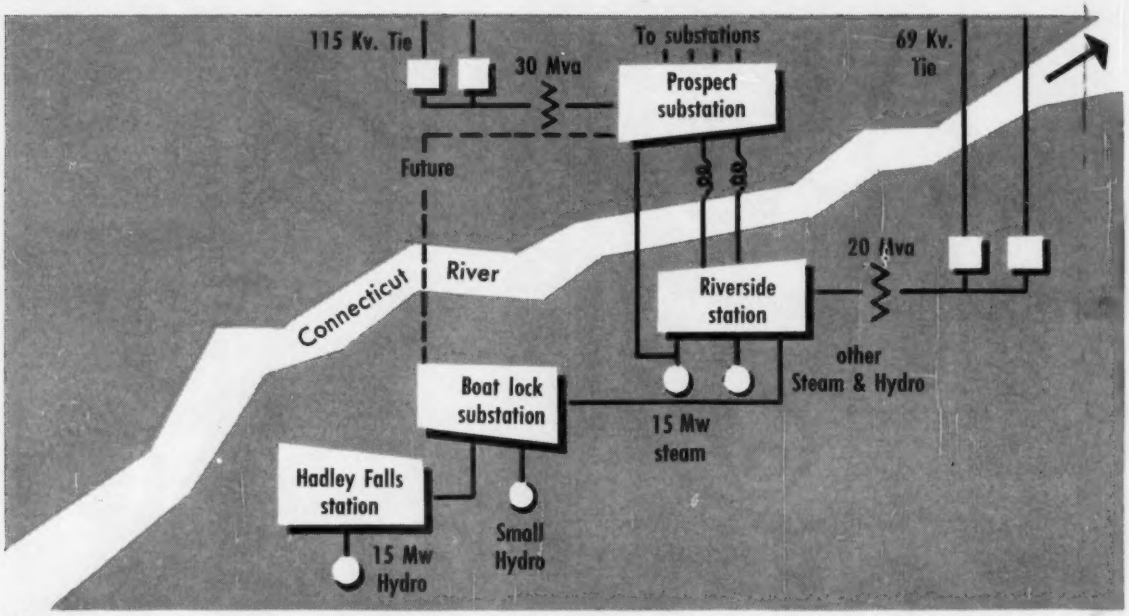
James R. Thompson, Kentucky Utilities Co, discussed the accident prevention possibilities of a new "Live Line Hazard Demonstrator" built by John F. Phelan, Indiana & Michigan Electric Co. The demonstrator, energized at 15,000 v and having 30-ma capacity, is used in accident prevention work.

Kansas City Power & Light Co has developed new standards for substation grounding and has made use of a large quantity of hollow copper conductor removed from 161-kv lines for substation grounding, said J. E. Hoopes. The new standards aim at more economical grounding and improved safety.

Maintenance Centralized

Kansas Gas & Electric Co adopted the central maintenance plan for power plants chiefly because it had three plants near Wichita, said H. K. Tatum. The central maintenance crew has also maintained the Neosho plant, 140 miles from Wichita, at an appreciable saving. The method saves labor, shop space, and equipment at individual plants and makes for uniform practices, with fewer men required. Estimated savings have been $12,000 a year.

The best remedy for generator overloading is system planning, said Miles Maxwell, Westinghouse Electric Corp. There is no "allowable overload." Overloads of any duration reduce insulation life. Relays should protect against unbalance, he said. Loss-of-field relays provide protection for loss of excitation.



PROSPECT SUBSTATION is under construction across the Connecticut River from Riverside station, main steam station and tie point for 13.8-kv system. It is the site of the new 750-Mva outdoor switchgear used by Holyoke Water Power

750-Mva Switchgear Economizes on

Outdoor metal-clad units at new substation site solve space problem for Holyoke Water Power, cut construction outlay and outage time in expansion of 13.8-kv facilities

R. H. WALKER, Holyoke Water Power Co, Holyoke, Mass.

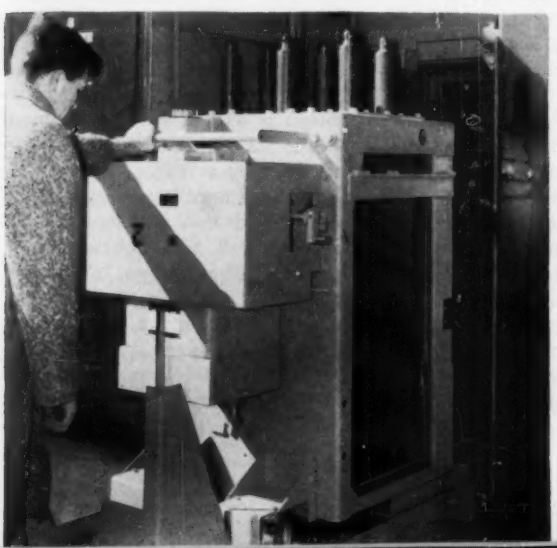
A. P. JACOBS, Design Engineer, Medium-Voltage Switchgear Department, General Electric Co, Schenectady, N. Y.

Resort to 750-Mva outdoor metal-clad switchgear gave Holyoke Water Power Co increased capacity to meet load growth on its 13.8-kv system at a minimum of outage time and expense for construction.

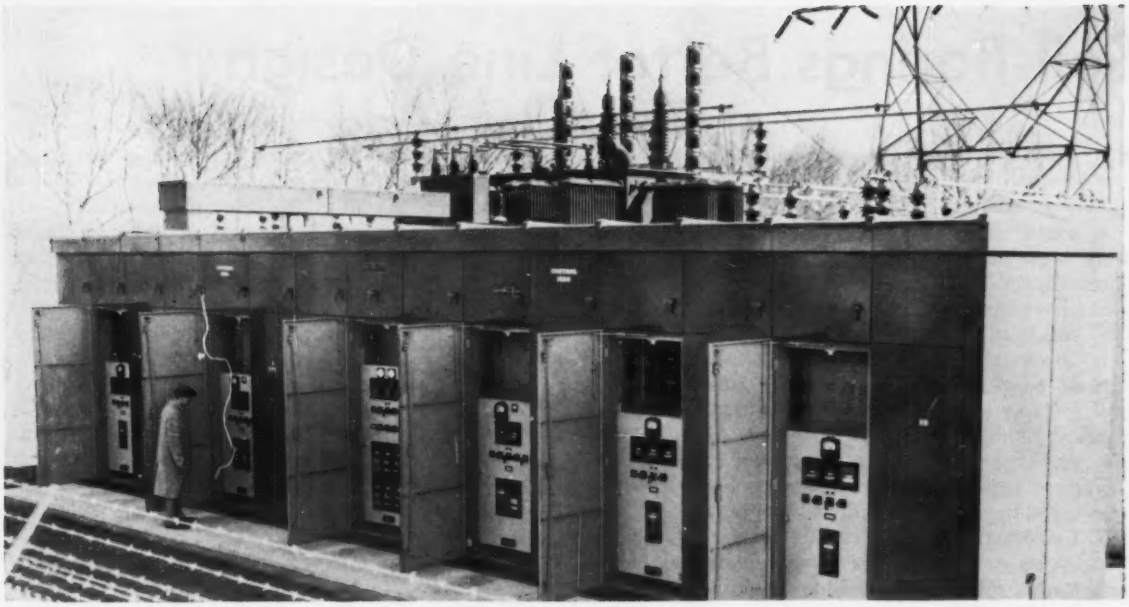
At Riverside station, Holyoke's main steam station and tie point, the 13.8-kv breakers are in masonry cells. Additional generation or more ties would boost the interrupting duty of these breakers above their 500-Mva rating and, accordingly, the space to accomodate a larger size. Besides lack of space, the cost and outage time prohibited expansion there.

The new Prospect substation was proposed. It could be situated about 1,200 ft away, directly across the Connecticut River and adjacent to 115-kv transmission and hi-line rights-of-way. It appeared that new 30-Mva, 115 to 13.8-kv step-down transformation there would not only augment the ties, but allow continued use of Riverside's 500-Mva breakers. River-crossing feeders, when bifurcated, could be the between-station ties. These arrangements would release breaker positions at Riverside.

An ac network analyzer study showed that breaker interrupting duty was a definite limitation to the plan. To maintain both stations below the 500-Mva interrupting duty, many combinations of reactors and split buses were tried. But these time-proven expedients solved neither the economic nor the space problem. Keeping Riverside's breaker duty below 500 Mva meant that breaker duty at Prospect would have to exceed that value. Reactors on the crossing ties, required in this latter arrangement, could be in-



CIRCUIT BREAKERS like this metal-enclosed, dead-front, 13.8-kv oil circuit breaker shown rolled out are installed



VIEW shows control panel side of the new 750-Mva outdoor metal-clad switchgear installed at Prospect substation as part of the company's expansion of facilities for meeting an increasing customer demand on its 13.8-kv system

System Growth

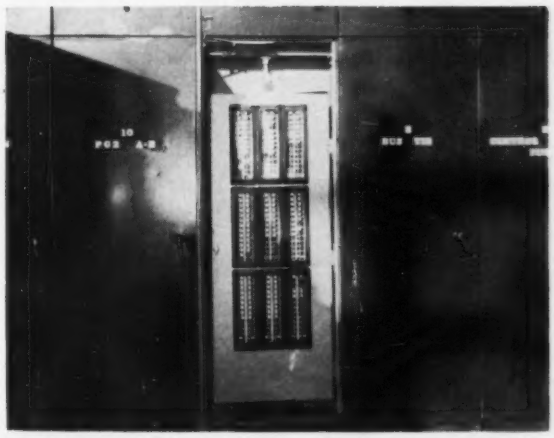
stalled at Prospect substation where space could be had readily.

A 750-Mva breaker rating, the ac analyzer board study showed, would fit nicely present and future duty conditions at Prospect. Holyoke was advised in the spring of 1955 that such breakers were being designed for metal-clad switchgear. When this new breaker rating was compared with the conventional 1,000-Mva outdoor station, economics, space requirements, and the savings on installation time favored the 750-Mva units.

One of the first outdoor metal-clad switchgear usages in this country of the 750-Mva-13.8-kv air circuit breakers is now nearing completion at the new Prospect substation. It is unique in that the outlying supervisory control equipment is contained in an auxiliary compartment.

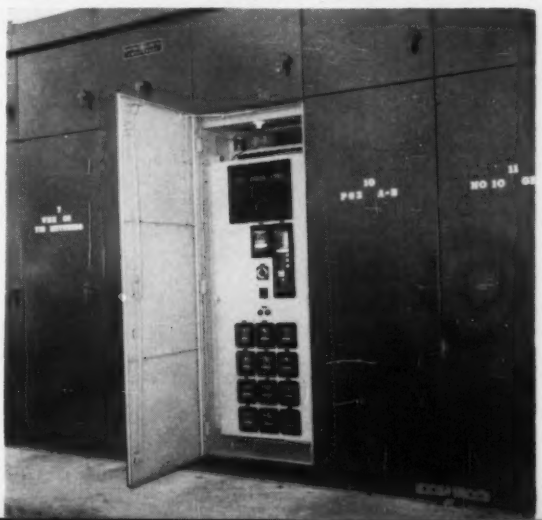
At Prospect substation are 15 cubicles controlling 12 circuits, a bus tie, and a transformer tie. It embodies the integration obtained in metal-clad switchgear.

With the exception of the control battery, the gear is entirely self-contained. The metal-clad units contain the standard complement of current transformers, control power transformers, control devices, and protective relays. Lightning arresters and drawout potential transformers are in superstructure compartments. All supervisory wiring for controlling and synchronizing each circuit, as well as for telemetering, is an integral part of the switchgear. This integration eliminates the tremendous amount of wiring needed for supervisory control equipment housed in a separate building.



FRONT VIEW of a Prospect substation 13.8-kv outdoor metal-clad switchgear shows unit's supervisory control

BACK VIEW shows Holyoke Water Power Co's unit substation with 13.8-kv outdoor switchgear, telephone relays



Soil Borings Better Line Design

A. V. DIENHART, Civil Engineer, Northern States Power Co, Minneapolis, Minn.

A policy of making soil borings at practically all tower sites has been developed by Northern States Power Co on the basis of its experience with extensive transmission-line construction over the past five years. This policy affords these advantages:

1. Structural designers can choose the appropriate type of tower foundation (concrete spread footings, steel grillages, or piles) on the basis of economy and practicability.

2. Designers can prepare more precise and, consequently, more economical designs, upon the basis of foundation depths, footing sizes, and pile lengths.

3. Construction forces can plan work more efficiently, because the borings show ground-water levels, permitting a forecast of probable requirements for dewatering, sheeting, excavation slopes, and imported backfill.

4. Route planners can consider revisions in alignment when borings indicate serious foundation problems.

Soil borings have just been completed by NSP at the foundation sites for 62 steel towers which will be erected for two 115-kv transmission lines in St. Paul.

The boring hole was cased with a 2½-in. pipe, driven by a drop hammer suspended from a portable frame and hoisted by a gasoline engine. The interior of the casing was cleaned by a water jet as the casing was advanced.

Soil samples were taken at each stratum by stopping the jetting and inserting a 2-in. split sampling tube inside the casing. The density of each stratum was measured by counting the number of blows of a 140-lb hammer, dropping 30-in., to drive the tube 12 in.

Results of each boring showed depths and thicknesses of the soil strata, gave textural description of each stratum, and showed blows per ft on the sampler at the levels where samples were taken. The samples, kept in jars for the duration of the projects, could be examined and subjected to laboratory testing.

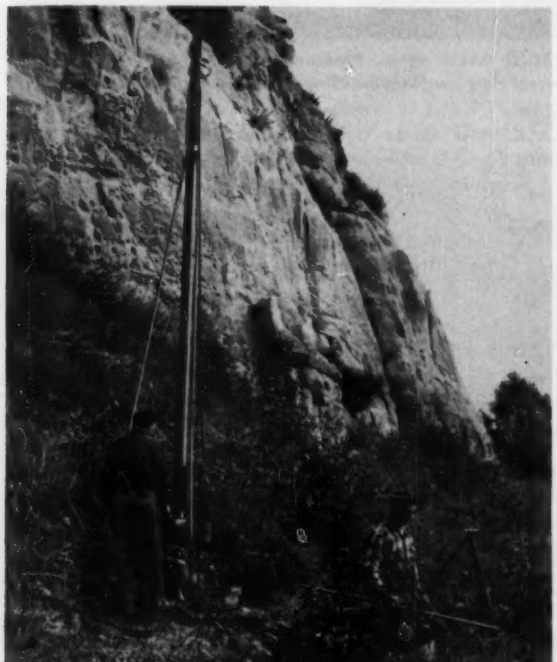
The cost of a boring is a function of depth, difficulty of penetration, and site accessibility, so that it is difficult to forecast the expense of the boring program. The boring crew was engaged at a daily rate, including overhead and profit. The depth at which each boring terminated was decided by NSP engineers as work progressed.

The cost of 68 borings for the two lines was $13,000, an average of $190 per boring. Cost of the boring program was 0.9% of estimated total construction cost.

Final foundation designs for the 62 towers provided spread footings for 37, cast-in-place concrete piles for 17, and steel grillage earth anchors for eight. At most locations where the borings showed that piles were needed this was not apparent from observations of the terrain. Conversely, in several locations where surface conditions suggested piling, the borings disclosed that less expensive footings could be used.

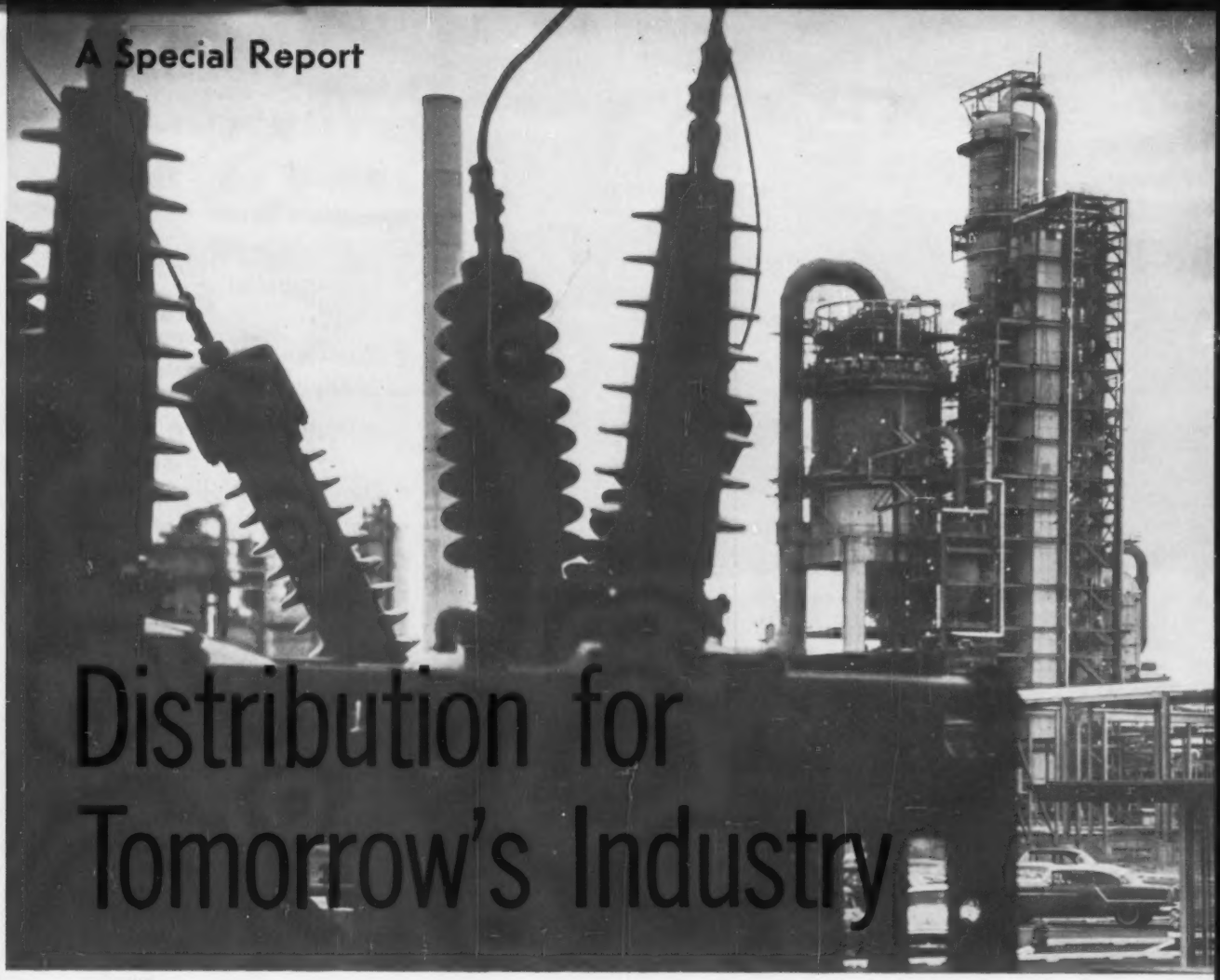
Where the borings disclosed unusually good foundation conditions, steel grillages were used to provide the least expensive foundations. In all locations where spread footings were provided, the borings prevented overdesign by supplying a realistic value of unit soil bearing capacity and an appropriate depth for placing the footing.

BORINGS at sites of 62 steel towers for two 115-kv transmission lines provided footage data for the designers



STANDARD TECHNIQUES and simple equipment were used for boring and the average cost came to $190 per boring

A Special Report



Distribution for Tomorrow's Industry

KENNETH N. McLEAN, Industrial Editor

The vitality of American industry depends on the adequacy of its electrical distribution systems. Today these systems are growing faster than production capacity as the number of kw per worker continues to soar. Experts predict even sharper increases.

Automation will speed this growth. Tomorrow electricity will be both the muscle and the brain of industry as the controls replace human judgment. But haphazard growth is not enough. To provide the capacity, reliability, and flexibility required, tomorrow's systems must be planned. And because tomorrow is just over the horizon, the planning must be done today.

This report delineates the need, the requirements, and the means of obtaining industrial electrical adequacy to speed its fulfillment.

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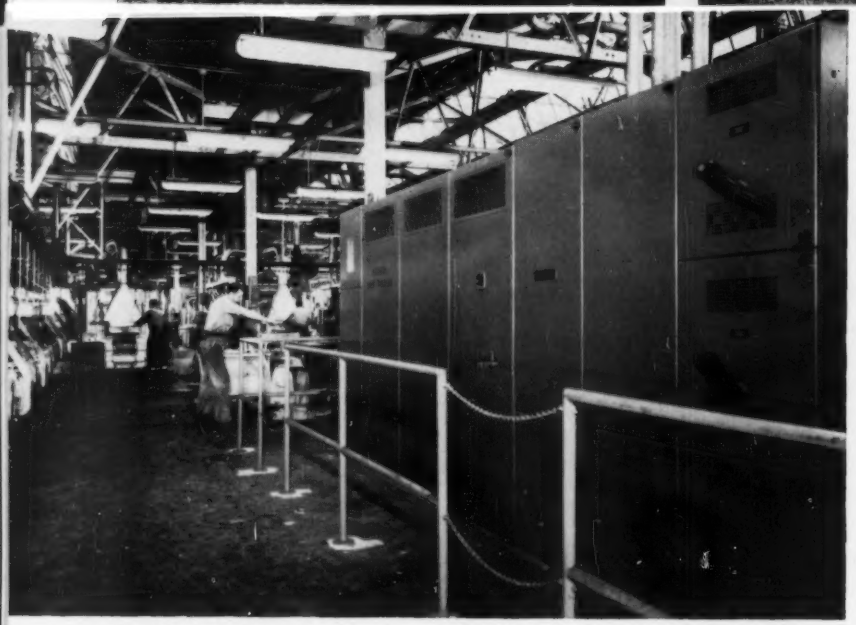


MODERN SECONDARY network power center includes low-voltage breakers, disconnects, network protector, dry-type transformers, and high voltage selector

Why Today's

- Reduced reserve between operations in automatic production makes reliable power supply essential
- Continuous rearrangement of production lines to cut cost stresses flexibility
- Downtime dollar losses same for small plant or single department of large plant

H. E. LOKAY, Distribution Engineer, Industry Engineering Dept, Westinghouse Electric Corp, East Pittsburgh, Pa.

Industrial electrical distribution systems provide the power to produce the goods that constitute this nation's booming economy. Although representing only a small portion of total plant investment, they are an essential to production and national prosperity.

Today industrial plants are expanding and modernizing to meet consumer demands for more and better products. In the past ten years, manufacturers spent $113 billion in such programs and, according to indications, will continue to spend $15 to $17 billion yearly for the next five years. With an investment of this size at stake, the electrical distribution system must be at least as modern as the production facilities.

New Equipment Not Enough

The age of a power system is not necessarily an index to adequacy. A distribution system need not have all new equipment to be modern. A system in an old plant is modern when it meets the qualifications below. Paradoxically, many distribution systems in new plants, using all new equipment, do not meet these requirements.

A modern industrial plant system should serve the required electrical load with the performance desired in any conditions and readily accommodate new production techniques beneficial to the product at minimum cost and with minimum changes or additions.

Requirements for a modern distribution system are the same for all types of industrial plants, but the degree of economic importance of each depends on the individual plant. The product, the manufacturing method, plant size, and the number of employees have a bearing on the economic value of a system.

Must Maintain Production

The criteria for judging an industrial distribution system hinge on (1) its ability to serve the load reliably, (2) to provide adequate voltage at the utilization equipment for efficient operation or performance, (3) to accept load changes and additions within the system, and (4) to permit system expansion.

The economic importance of reliability lies in the necessity to maintain production. Idle facilities, both machinery and people, during normal working hours cost money. The volume of production lost during an outage depends upon the cause of the stoppage; that is, whether it is from a sudden electrical fault or from a planned outage for maintenance. Location, time of occurrence, and duration of the outage affect the cost of the production stoppage.

A survey of industrial plants was made to determine the actual dollar cost of a service outage and obtain some measure of the economic importance of service reliability. In the tabulation on page 103, the indicated downtime dollar loss per hr is for a complete plant shutdown for a total outage time not longer than 12 hr. For extended outages, this loss may exceed appreciably the band of losses in the table.

The downtime dollar loss includes wages of the workers idled during the outage, the potential profit from sales lost as a direct result of the outage, material and equipment damage attributable to power failure, the material handling unbalance, taxes, insurance, interest, etc. Other items, such as delivery dates missed, re-running performance or miscellaneous tests, or the cost of emergency repairs are not included although they can be important.

List Factors in Loss

A band is shown for the downtime dollar loss as many factors influence its amount. These are time of day of the outage, duration, extent of machinery and material damage, and the effect of production loss on manufacturing not associated with the electrical failure. In a process using molten metal or

Factory Needs Modern Distribution

forming glass, an outage beyond a certain length of time—perhaps only a few minutes—can solidify the product and cause extensive equipment and material damage. Life tests of material and products may be affected during long outages. Whenever the test is based on continuous duty, an interruption means starting all over. A prolonged start-up time may be necessary before electric ovens or furnaces resume production.

Compare Large, Small Plants

The survey showed that where the type of manufacturing is similar and the number of people and electrical load are approximately the same, the dollar loss for one portion of a large plant is about the same as that in a smaller single plant completely without power. The dollar loss in the table for kva demands of about 2,500 kva or less applies also to a primary feeder outage, with no alternative supply, in a large industrial plant having several primary feeders.

In plants No. 6 and No. 7 the estimated dollar loss for an outage of the primary feeder serving the fabricating and assembly metal-working area was the same as for plant No. 1, a small plant that did only that type of manufacturing. Similarly, the dollar loss for a power failure in the general assembly areas. of plant No. 7 was about the same as that from a complete outage in plants No. 2 and No. 4.

Maintenance Outages Costly

Downtime for maintenance on electrical equipment can represent a substantial power outage dollar loss, particularly in 24-hr, 7-day week production. Even though the outage time can be scheduled to minimize the outage time dollar loss, dollar loss values for maintenance sometimes run as high as the outage values for small plants. Maintenance is, of course, necessary and sometimes an outage is unavoidable. But in certain designs, portions of the system can be taken out for maintenance without causing a power outage.

A system failure may not always cause a complete power outage. An-

Estimated Dollar Loss for Industrial Plant Down-Time

General Plant Type	Approximate Number of People Employed (Hourly & Salaried)	Approximate ½ Hr Maximum Peak Demand, Kva	Downtime Dollar Loss per Hr
1. Metal Working (Fabrication and assembly of sheet metal parts including enameling processes)	500	2500	$2000 to $4000
2. General Assembly (Conveyor driven assembly lines, medium and small parts and testing facilities)	1600	3000	$9000 to $12,000
3. General Assembly—Small parts (Complete automation—metal working, machining, and coil winding)	230	700	$750 to $2000
4. General Assembly—Small parts (Non-Automated — metal working, machining, coil winding)	380	1500	$1750 to $3500
5. General Assembly — Small parts (Non-Automated — metal working, machining, coil winding)	300	1100	$1500 to $3000
6. General Manufacturing—Small and medium parts (Metal working, machining, misc furnaces and ovens, coil winding, general assembly, test and research facilities)	1500	4500	$3000 to $6000
7. General Manufacturing—Small and Medium parts (Metal working, machining misc furnaces and ovens, coil winding, general assembly, test and research facilities)	4000	9000	$15,000 to $18,000
8. Glass Products (Glass forming machines, misc. machining, testing and general assembly)	800	2200	$4000 to $8000
9. Glass Products (Glass forming machines, misc. machining, testing and general assembly)	1100	4000	$5000 to $10,000
10. Electronic Parts—Small (Small machines, ovens, coil winders, general small assembly)	200	1500	$2000 to $8000
11. Electronic Parts—Small (Small machines, ovens, general small assembly, glass forming machines)	1500	5100	$12,000 to $16,000

other common consequence is a forced reduction in manufacturing. One such example was plant No. 7 in the table where two transformers in parallel serve the entire plant. With one transformer on the feeder lost, the remaining transformer could not serve the entire load. It was estimated the plant would have to reduce production 20% at a loss of $2,000 to $3,000 per hr.

The growing importance of a reliable distribution system, as mechanization and automation increase, is pointed up by comparing outage losses at two plants. Plant No. 3 is completely automatic and is served by a 4-kv feeder. The dollar loss was estimated for that feeder out. Actually, the dollar loss would be almost the same for any electrical failure affecting the automatic process, whether in one of the power centers stepping the voltage down to 120/208 v or on one secondary feeder. A failure in one portion of the automatic process would cause loss of the entire line.

Automated Lines Critical

In plant No. 4 manufacturing is very similar to that of plant No. 3, but the production facilities are not automatic. Here a power center or secondary feeder outage would affect only a few operations. The estimated dollar loss due to a few lost operations is only $100 to $200 per hr, much less than the automated production.

The big difference between these losses comes about from the reserve maintained between operations. In non-automatic production lines this reserve generally ranges from several hours to a few days. In the automated lines little or no reserve is maintained.

Flexibility in an industrial distribution system is economically important; it represents the ability to accept at low cost load changes due to new production techniques or product advances that in turn, yield low-cost production. It was discovered that annual expenses for re-aranging facilities average about $10,000 for small and $100,000 for the larger plants. While the electrical system cost is only a small portion of dollars spent, the figures indicate the extent of continuous rearranging for more and lower-cost production.

When distribution systems are installed today, some spare capacity is included. As new loads are added, every attempt should be made to use this capacity to minimize costs. Unless flexibility has been built into the system, freedom as to location of the new load is limited.

Cite Flexibility Need

In one plant, $20,000 was spent for a new 500-kva power center to permit a slight load growth caused by re-arranging production machinery. The plant's electrical engineer stated that, had the system been more adaptable to load transfer, it would have been possible to take advantage of the spare capacity in the system. No additional equipment would have been necessary. The cost of the new arrangement would have been even higher were a new primary feeder needed.

System flexibility should permit moving production equipment within the system at minimum loss in production time. This is extremely important in plants developing, testing, and manufacturing continuously changing products, such as appliances, aircraft, and automobiles. The use of plug-in bus duct within a plant helps in minimizing loss in production time. Electrical connecting and disconnecting time has been reduced on an average to half of that required with conventional methods. The surrounding production area need not be deenergized for connecting or disconnecting the duct. One plant engineer reported that the average electrical cost to move a medium-sized screw machine was $40 where plug-in bus duct was available, compared to $75 with conventional connections.

Cuts Equipment Life

Adequate utilization voltage assures efficient equipment performance. All electrical equipment has maximum and minimum voltage limits for reasonable operating efficiency and life. These values vary accordingly to the type. The spread for motors is $\pm 10\%$ around nameplate voltage; for lighting it is slightly smaller.

Moreover, voltage has definite effect on the operating efficiency of many types of equipment. In resistance heating equipment, heat developed is proportional to the square of the applied voltage. Voltage affects the rate of heating, and voltage decrease increases the time to raise a piece of material to a specified temperature. Where resistance heating is necessary, low voltage increases production time, affecting the economy of the entire procedure.

Similarly, with voltage 10% below the rated value, incandescent lamp output is reduced to 70%; fluorescent output to 90%. While it is difficult to measure directly the economic effect of reduced lighting, it is important in maintaining efficient operation.

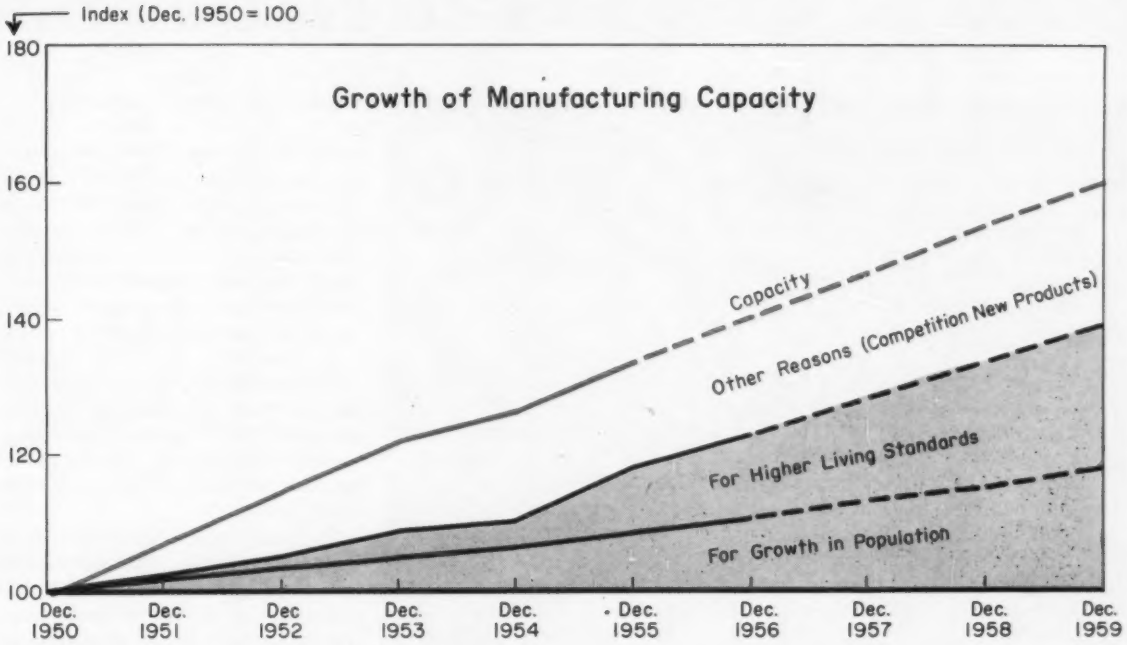
A further indication of the economic importance of adequate voltage can be illustrated with induction motor performance. The starting and running torques vary as the square of the voltage. Full load current increases as voltage decreases. Hence, low voltage may require a decrease in motor capability to prevent overheating and reduced life. In one plant, inefficient operation of three machines due to low voltage justified the addition of an autotransformer costing $1,400 to boost the voltage.

Excessively high voltage has an adverse effect on manufacturing economy. While adequate equipment performance can be maintained, the excessive voltage can reduce equipment life considerably, This raises capital expenditures, and increases maintenance costs.

System Must Ease Change

Today, production techniques change or improve to give more efficient operation with almost every technological advance. Under today's increasingly competitive conditions the industrial plant electrical distribution system must facilitate the adoption of new techniques. It therefore holds a key position in the economy of the industrial plant. It stands to reason that the distribution system must stay as modern as the production techniques.

To obtain and maintain a modern system sometimes means replacing old equipment with new. But well planned modernization keeps the system flexible enough to accept beneficial load changes or system expansions, assures good service reliability where it has an economic return, and maintains adequate voltage within the necessary limits at the point of utilization.



Source: McGraw-Hill Dept. of Economics, U.S. Dept. of Commerce

TOTAL U. S. INDUSTRIAL capacity, climbing steadily since World War II, will grow another 15% by end of 1959. Rising population, steadily increasing standard of living, abundance of new products, all contribute to future growth

2 Factors Spur Capacity Growth

Rising consumer demand, outracing labor force, means more kw per worker tomorrow

The production capacity graphs on this page explain the immense upsurge in industrial electric power system capacity. Between December, 1951 and the end of 1955 U. S. manufacturing capacity shot up almost 25%. And the increase in some basic industries ran well ahead of the national average.

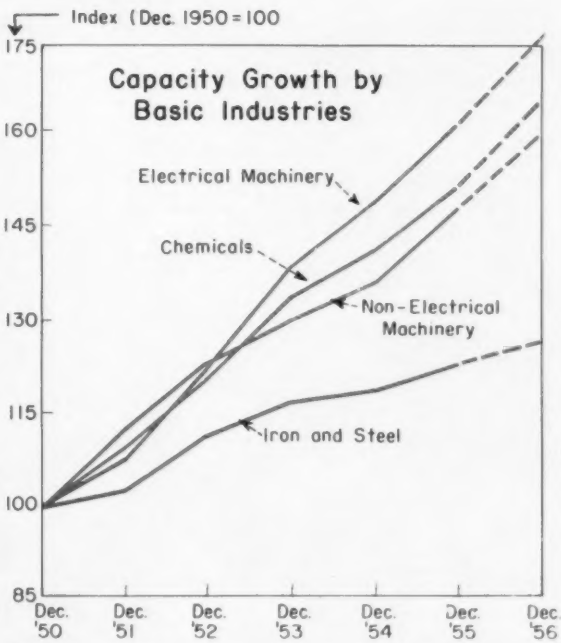
In the 4-year period ending 1961 industry will spend 10% more capital each year than in the like period ending 1957 when expenditures averaged $15.5 billion —including electrical facilities.

From 1952 through 1955, moreover, industry's share of the total kwhr increased almost twice as fast as the total manufacturing capacity, showing a gain of 58%.

What does all this mean to the industrial electrical engineer? More capacity means bigger loads and bigger systems to carry them. Both mean more work and more responsibility for industry's electrical engineers.

More important it means systems planned and built with an eye on the future. A system designed only for today will be obsolete tomorrow. A modern system must be able to keep pace with the industry it serves easily, economically and without disrupting production.

How this may be brought about through careful design is told on the following pages.



Source: Federal Reserve Board, McGraw-Hill Dept. of Economics

GROWTH in electrical manufacturing runs well ahead of average, reflects growth of industrial electrical systems

How to Evaluate Your

- **Scheduled surveys provide dynamic record of overall system adequacy, head off sudden obsolescence**
- **Small margin for immediate growth, expandability for large future increases characterize modern design**
- **Failure rate, simplicity, distribution losses, protection for equipment, personnel are evaluation criteria**

Industrial engineers today agree that electrical distribution in a modern plant must provide sufficient power of the correct characteristics in the required location at minimum cost and with maximum safety to personnel and equipment. Two important economic factors are putting a premium on adequacy:

- The steadily rising investment in plant productive capacity has made a reliable, safe and economical system essential.
- The continually growing demand for more products, new products, and new techniques has made the adaptability of industrial distribution systems critical.

Adaptability today is more than just the ability to handle a moderate, immediate increase or cope with a rearrangement in the production line. It means ease in modifying the system for future large increases in load and the ability to double or triple capacity without scrapping large, expensive equipments.

In many plants the growing trend to mechanization and the resulting increase in power requirements have created overloaded, unreliable distribution systems. Most of these are older plants. But there are many new ones whose production has grown too fast for the existing facilities. Such systems can't handle today's load adequately, much less prospective increases.

Because load growth is often a slow process, a once-adequate system becomes outmoded by gradual attrition without the transition being noticed. Symptoms of inadequacy are specific and take at least three major forms:

1. Excessive operating costs. This includes costs of power losses, of labor and equipment for electrical maintenance, and of lost production due to outage or other electrical deficiencies.

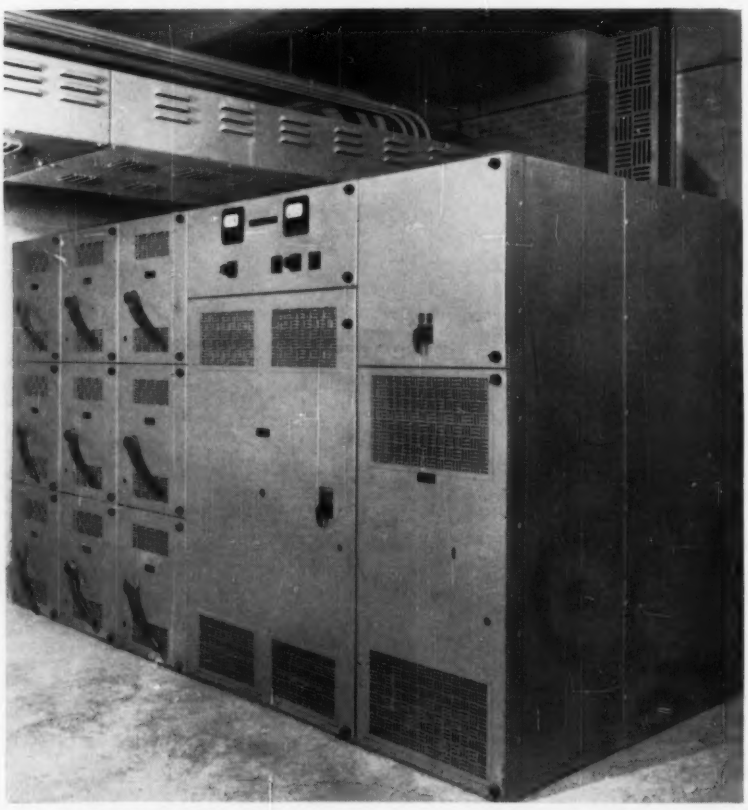
2. A steady increase in equipment losses or personnel injuries.

3. The inability to handle a new or increased load without repeated breakdowns and failures.

These symptoms are conclusive. They are also expensive and dangerous. When they appear, serious trouble is at hand. Consequently, it is unwise to assume that a distribution system is adequate because specific indications to the contrary are not obvious. It is equally unwise to wait for such proof.

A continuous program of scheduled adequacy surveys provides a reliable and dynamic picture of electrical systems' "adequacy quotient" when applied to system components from source to point of use.

The accompanying check list was compiled to guide such a program. It covers five major criteria. While neither complete nor all-inclusive, it will aid in preparing a more specific program for an individual plant.



METAL-ENCLOSED LOW-VOLTAGE switchgear for 1,500-kva spot network is safe, clean. Both bus duct and cable in conduit is used for low-voltage feeders

CAPACITY

Size is the first measure of capacity. Compare the spreads between connected load, system capacity, and demand. Watch for a narrowing gap between capacity and demand as a sign of aging. Then check voltage regulation, distribution losses, and efficient equipment operation, the other measures of

Electrical Distribution System

true capacity, with the list that follows:

☐ Is your total capacity at least 25% above demand?

☐ Are the utility lines serving you ample enough to allow at least a moderate expansion?

☐ Is your voltage regulation good enough for present needs and the more stringent demands of automation?

☐ Can you get full starting torque on induction motors?

☐ Have you installed corrective capacitors to give you full use of your nominal capacity?

☐ Similarly, have you used synchronous motors instead of induction motors for large, slow-speed applications?

☐ Have you minimized voltage drop in cable runs by using a load center distribution system?

☐ Are your phase currents sufficiently balanced to avoid overheating in motors and generators?

☐ If you have large welders or other high intermittent-current equipment, have you used separate lighting feeders to eliminate flicker?

☐ Do your larger transformers have provisions for fans if a temporary overload becomes necessary?

☐ Have you minimized motor starting effects by supplying units of 100 hp directly from the transformer and saving secondary distribution capacity for smaller equipment?

☐ Do illumination levels satisfy at least the minimum industry recommendations: 30 ft-c for general manufacturing areas 50 ft-c for difficult tasks, 100 ft-c for precision work?

LOCATING low-voltage switchgear in production area reduces secondary distribution runs and voltage drop. Modular construction facilitates expansion

RELIABILITY

Reliability is the most obvious mark of an adequate electrical distribution system. A sound, well-designed system can go through years of heavy, continuous service without being noticed. The inadequacies of an inferior system are immediately apparent, for when power supply fails or deteriorates production stops.

And today as industrial automation grows and production techniques become more complex, reliability requirements tighten. In the face of these conditions, how does your system measure up?

☐ Are your service interruptions steadily increasing?

☐ Does the system reliability match your process needs? Excessive reliability ties up production capital unnecessarily; insufficient reliability means expensive production interruptions.

☐ If yours is a continuous process industry, such as refining, textiles, paper, or steel, have you considered duplicate substations with automatic throwover, a primary selective system, or even duplicate utility supplies?

☐ Are the system units relatively independent? Or will failure in one area shut down the entire system?

☐ Does the system design enable you to drop less important loads and pick up vital ones when a failure suddenly cuts your capacity?

☐ Have you cut reliability by "economizing" at the expense of equipment quality?

☐ If your system operates ungrounded, have you developed a good fault-locating system and trained people to use it?

☐ Do you have a secondary selective distribution system in areas where load can not be dropped for long periods of time?

SAFETY

Adequate protection for both personnel and equipment is essential in a modern industrial electrical distribution system. Although management is keenly aware of the importance of a safe operation and alert for dangerous situations, hazardous conditions frequently creep in when equipment is shifted and new techniques adopted. Rate your present practice against these basic precautions:

☐ Can basic equipment be taken out of service for maintenance without a major shutdown?

☐ Does your substation include a fire-protection system?

☐ Does your plant have well designed lightning protection?

☐ Does your switchgear have both adequate continuous-current ratings and an ample interrupting capacity?

MODERN POWER CENTER, located on elevated platform in the manufacturing area, means lower installation costs, greater flexibility to cope with load change

☐ Are your circuits overfused, unable to protect expensive investment in plant and production?

☐ Do you have a well organized maintenance program to keep protective equipment in repair and properly coordinated?

☐ Do you review your overcurrent practice periodically?

☐ Are you using metal-clad, deadfront equipment to reduce the chance of accidental contact with hot components?

☐ Is your equipment adequately interlocked to prevent injury to operating and maintenance personnel?

☐ Do you maintain an accurate record of failures, with as much detail as possible, to help eliminate potential danger points?

☐ Where conductors from different sources enter a single equipment, is each adequately identified?

☐ Are heaters, fans, and thermostats on drying ovens and similar equipments adequately interlocked to prevent explosive accumulations of vapors?

ECONOMY

Unless your budget is unlimited, these checks should need little explanation. Although almost all other standards eventually affect economy, the direct charges below are among the first you should examine.

☐ Are you using duplicate service entrance and duplicate metering that your system doesn't need?

☐ If reliability requirements are only moderate, have you used a simple radial system to reduce first cost and cable cost?

☐ Does your design waste power in serving widely separated loads from a single, low-voltage cable run?

☐ Have you reduced the number of types and standardized as far as possible on motors, transformers, cable, and switchgear to limit the space and capital tied up in replacements and take advantage of low-cost, mass-produced items?

☐ Are you paying for power you can't use because of an unnecessarily low load power factor? Have you checked the cost of installing corrective capacitors on resistance welders or induction motors consistently run under a light load?

☐ Are overloads shortening your circuit life, boosting replacement costs?

☐ Does the complexity of your system complicate troubleshooting and increase your maintenance costs?

☐ Can you shut down one portion of your system for maintenance without disabling the entire system?

☐ Does inaccessibility of cables and equipment make maintenance difficult and expensive?

☐ Have you used a 480-v secondary power system wherever practicable to cut power costs and reduce the size of breakers and conductors?

☐ Was your system designed around a 3-phase, 60-cps, low-voltage system to hold down replacement equipment costs?

☐ Have you investigated the practicability of an outside installation?

☐ While leaving a safe margin for load increase, have you avoided excessive overmotoring?

☐ Is your substation near the greatest load concentration, thus minimizing primary cable runs?

ADAPTABILITY

Check this list with your eye on tomorrow. Remember adaptability means both flexibility for a line change or small increase this year and large-scale expandability to meet expected demands of the next 10 years. A well designed distribution system needs both.

☐ Does a plug-in bus duct, low-voltage distribution system enable you to rewire areas quickly and inexpensively, without scrapping large amounts of cabling when production demands or techniques change?

☐ Do your main transformers include tap-changing provisions — automatic where voltage level is critical, manual where it is less so?

☐ Is equipment accessible enough to facilitate changes when power requirements change?

☐ Can you superimpose a higher primary voltage on your present one if load suddenly increases?

☐ Could you double or triple the capacity of your system without junking much expensive equipment?

☐ Does the layout of your plant include space for additional substations, cabling, and switchgear if expansion becomes necessary?

☐ Does the modular construction of your system lend itself to easy expansion?

☐ Have you used the highest practical distribution voltages?

☐ Have you provided extra capacity in circuit breakers and switches to allow for moderate growth?

☐ Do your main transformers, other than those supplying a single large load, have at least a small growth factor?

How to Plan a Modern Industrial Distribution System

- Here is a step-by-step outline of the engineering decisions in designing a modern distribution system
- Basic tenets are: Plan for growth, keep it simple, use high quality equipment

MASTER SUBSTATION FOR stepdown to lower primary voltage is usually required when utility service exeeds 15 kv. Outside facilities cut installation cost

J. C. PAGE, Senior Application Engineer, Industrial Power Systems Engineering, General Electric Co, Schenectady, N. Y.

Adequate industrial distribution design depends on two equally important factors:

1. Making the right decisions on individual equipments and circuits.

2. Starting with the proper design perspective.

Initial planning is important—but should be considered as a single cycle in the recurring process of load growth and expansion, rather than as a one-shot operation.

Modernization, expansion, and "new" construction are so subtly related that it is often difficult to distinguish one from the other. Arbitrary distinctions may make it more difficult to see the problem as a whole. All three terms are better thought of as part of one process.

In the early planning stages it is easy to assume that the plant will not grow much electrically. This kind of thinking may lead to tightening up system design so far that growth can be handled only at great cost, if at all.

A more realistic approach is to assume that the load will double or triple its initial value and plan for it. The ultimate distribution system is planned for, although only part of it is installed initially. This concept should guide all system design.

A flexible design helps keep a distribution system modern in spite of change in manufacturing techniques or increased power demands. Obsolescence is retarded or prevented by various forms of unit systems and equipment. This implies an integrated, self-contained arrangement with a minimum of interconnection. Units are made as independent of each other as possible.

Reliability should be designed into a system, not by complicated circuit arrangements but by high quality equipment, well installed and well maintained. Experience proves that well-engineered systems with high quality equipment often prove superior to more complicated designs, especially in times of emergency. Under these conditions, a rattled operator may mistakingly shut down an entire interconnected system. In a simple system, these mistakes are far less probable.

With electric power systems becoming an integral part of the production line, safety should receive the utmost consideration. Equipment should be metal enclosed and properly grounded to insure maximum protection.

While system cost is important, there have been many cases in the field involving production shutdowns which were more expensive than the entire electrical system. Industrial power costs between 2 and 5% of the total plant cost. As one operator ruefully admitted, "We seem to pay for a good system, whether we get it or not." Planning makes the difference.

Where do you start planning your system? Certainly no two engineers plan a system in exactly the same sequence. Although individual techniques vary, they encompass the same general considerations but in a different order.

On the following pages 15 steps outline the general thinking process which takes into account the broad decisions necessary to arrive at an optimum system design.

15 Fundamental Steps Guide Design

1. Estimate Total Load

Survey your load requirements. Estimate your present load, indicating the size, location, and nature of each portion on a planning diagram. Note particularly the size and location of resistance welding machines, arc furnaces, and other equipment requiring special consideration. Include allowances for seasonal variation in heating, lighting, or air conditioning load. Estimate the typical load of any planned or forseeable new loads and add these to your present load.

2. Establish Reliability Requirements

For each load, set up reliability requirements, based on the nature and importance of the equipment involved. This step is basic—it differentiates essential loads from those of secondary importance. From it, you can determine the firm capacity required both in your primary sources and system equipment serving individual load areas.

3. Investigate Available Power Supply

Determine the type of service available from the local utility. Consult their industrial power department about the capacity, number of lines, voltages, and voltage regulation available in your district. Where is the nearest adequate utility line? Find out what are their short-circuit duty, service entrance protective equipment recommendations and, of course, rate structure. See what voltages are available for future growth.

4. Check Electrical Codes

Early in the planning, find out what national, state, and local codes apply at your plant location. Be sure the effect of the codes, both on the systems as a whole and on individual equipments, is considered from the beginning. It may prove costly to proceed with the design first and then find out that expensive changes in design and equipment must be made to meet electrical codes.

5. Survey In-Plant Voltages

Review the overall plant load to determine how many voltage levels are desirable within the plant. A small plant may require only secondary voltage, an intermediate both primary and secondary voltages. A very large one may need subtransmission as well as primary and secondary voltage. Pay particular attention to your motor loads. Motors of about 200 hp and below are economically handled at 480 v. Investigate the possibility of handling larger motors at higher voltages, especially when the size of your plant motors promises to increase.

6. Pick Primary Distribution Voltage

For total plant loads of 20,000 kva and higher, 13.8 kv is generally most economical. Below 10,000 kva, 4,160 v is more economical than 13.8 kv. Between 10,000 and 20,000 kva, the choice will depend on individual plant conditions.

If incoming power from the utility lines is available at a voltage above 13.8 kv, a main substation is usually required and it gives a wide latitude in selecting your distribution voltage. If the incoming power is 13.8 kv or below, there will be a strong incentive to use this voltage directly for plant distribution, particularly when the plant load is sufficiently large. Moreover, a higher primary voltage means lower copper costs, less voltage drop.

7. Compute Voltage Regulation & Flicker

In each of the plant systems under consideration, check to make certain you have made adequate provision for normal voltage regulation and flicker. Once again, pay special attention to your resistance welders, arc furnaces, and very large motors, which generally require independent treatment.

8. Select Secondary Distribution System

Here you have a wide range of alternatives available. Choose between:

- Combined power and lighting at 480 Y
- Power at 480 v with 120-v lighting supplied through lighting transformers
- A 208/120-v system
- Completely separate power and lighting system.

Your utilization voltages will make part of the decision for you. Safety codes and government regulations frequently specify the maximum voltage permissible for hand tools on work benches, or low-hanging lighting fixtures. Length of cable runs which, in turn, is affected by location of load center substations, must be considered in selecting your voltage.

Even where transformation is necessary to serve 240 or 120-v equipment, a 480-v distribution system is generally most economical if ⅓ to ½ the total load is served at 480 v. If soldering irons, hand drills, or other powered hand tools make up the largest portion of your load, the 208/120-v system may be the most economical.

But whatever your individual needs, pick the highest practical voltage. It means lower wiring costs, lower voltage drop, better motor operation, less

# of Modern Distribution Systems

danger of overloading your lower voltage circuits.

The wiring itself may be interlocked armor, busway, or cable and conduit. In choosing one of these, try to standardize on one cable type or at least, limit the number of types.

9. Select a Grounding System

The adoption of system neutral grounding at all voltages should be considered. The type of grounding will depend on the operating characteristics required. In general, low-voltage systems are solidly grounded and primary systems in the range of 2.4 to 13.8 kv are low-resistance grounded.

Some operators prefer that trip-out not occur when a ground fault occurs in certain parts of the system. For these cases, the answer is not ungrounded operation but a high-resistance grounded system.

10. Locate Secondary Unit Substations

Located in the load-center locations throughout the plant, these units form the link between the pirmary and secondary distribution systems. Break up your load in convenient batches to fit available equipment. Make allowance for future expansion. If using the nearest standard size unit cuts your space capacity too much, consider using two units of the next smaller size.

For 480-v service, the most economical size varies from 750 to 1,500 kva, depending on load density. For 2.4-kv systems, 2,500 kva is usually the most economical size; for 4.16-kv systems, 5,000 kva.

Generally, the smaller the unit, the more expensive it is per kva and the more primary cable required to reach the more numerous substations. On the other hand, if substations are too large, more secondary cable is needed and cost of switchgear goes up.

Common types are radial and secondary selective. General practice is to select one type and rating for use throughout the system.

When you have reached a tentative decision on load center substations, recheck earlier decisions on primary and secondary distribution voltages.

11. Compare Alternatives

Draw a one-line diagram of each basic system you are considering. Be sure each alternative includes provisions for estimated future load. Show construction planned for the immediate future in solid lines; future expansion in dotted lines.

Make sure each design has adequate capacity, can carry your full estimated load, and has adequate interrupting capacity. Recheck any or all of your previous decisions if necessary. Then make realistic cost comparisons of the installed cost of each system in its ultimate form.

12. Select the Basic System

This is the big decision. In making it, you must balance such factors as reliability, expansibility, simplicity, and cost. Draw on your previous experience. These and your good judgment are the important intangables.

Remember, the plan for your initial system should be a part of the plan for your ultimate system.

13. Test the Design

Check your design on the following points:

- Is it simple to operate and maintain?
- Can maintenance be done without working on energized conductors?
- Does it include a reserve for emergencies?
- Can one section be shut down without de-energizing the entire system?
- Is it flexible?
- Can it be built with readily available equipment?
- Can it be expanded without obsoleting original equipment?

14. Coordinate Overcurrent Protection

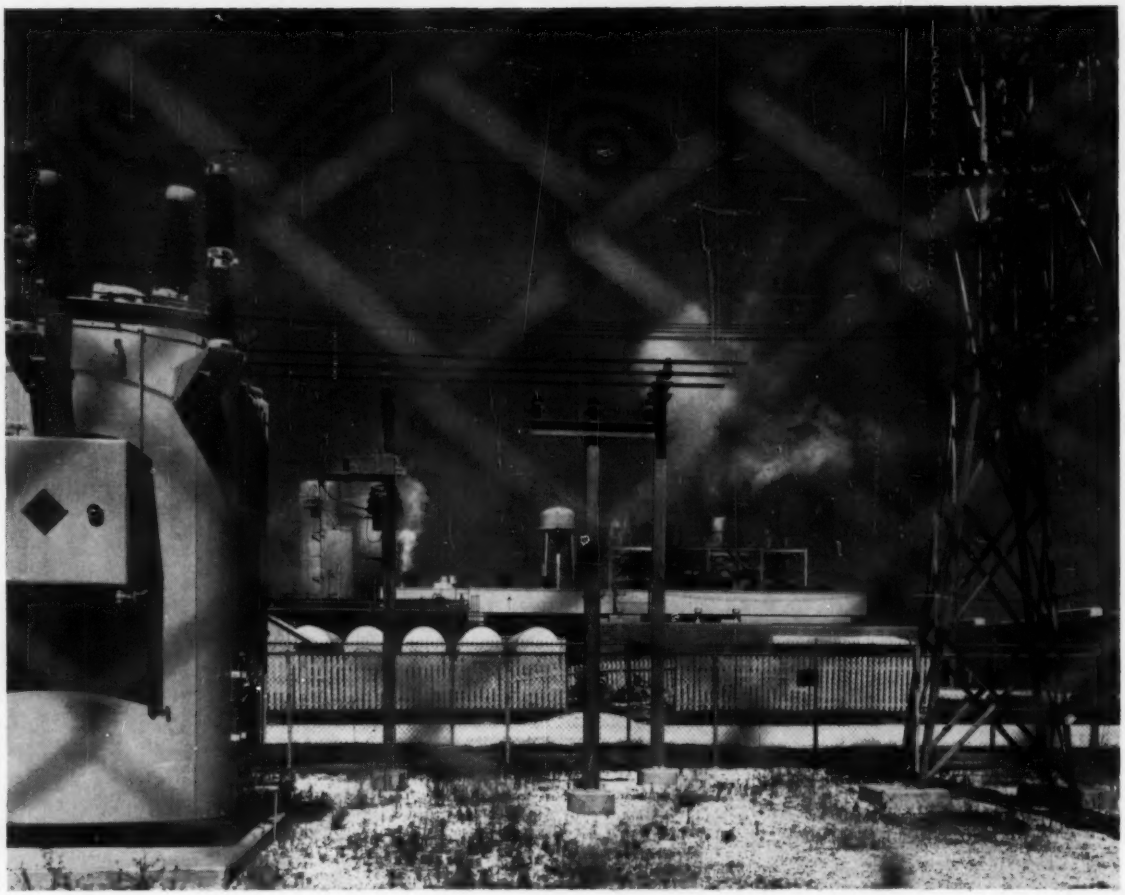
Effective overcurrent coordination of all circuit devices is essential for limiting the outage when a short circuit or overload occurs. In a proper coordinated system, only that portion of the system affected by the overload will be taken out of service. If the system is not properly coordinated, then healthy circuits as well as faulty ones may be opened with unnecessary loss of production.

To obtain coordination make a study, select the right ratings of equipment, and test them, both after installation and periodically thereafter.

15. Select Your Equipment

Now select the equipment you want to use. This includes switchgear, unit substations, transformers, regulators, cable and busway, lighting arrestors and grounding equipment, power-factor correction equipment, and panel boards.

Uniformity is desirable. Try to limit the number of types of any one equipment used. Select equipment which can be easily serviced. For safety, cleanliness, and appearance, consider metal-clad equipment. Finally, try to coordinate the protective devices of the different components to provide selectivity throughout the system.



Ten Tips That Sum It All Up

DON'T wait till other construction, modernization or expansion is complete to design your electrical distribution system. Today's production lives on electricity. Start planning your system as soon as you know where and what the loads will be.

TAILOR your system to meet the individual demands of your process and your plant.

DON'T confuse inferior systems or equipment with economy. If you make the right choices, you can eliminate all but the truly unavoidable outages.

TRY to make both your bosses and your production men realize that electrical facilities are a production essential, equally as important to them as raw material or process equipment.

DON'T be too proud to call in expert help from outside. The manufacturers know the equipment best, consultants have the edge on systems, and the utility engineer understands the supply problems.

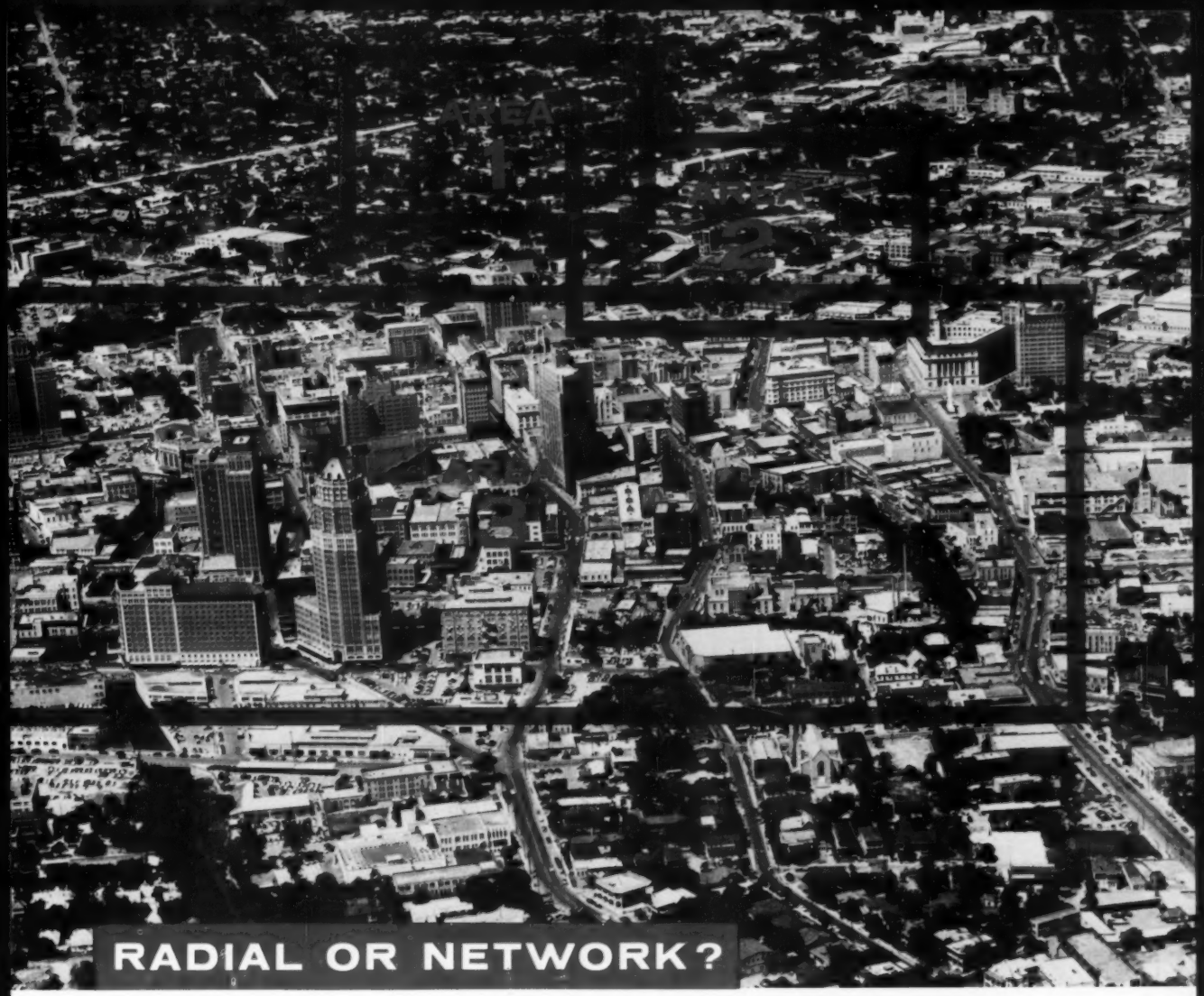
BE SURE your outside help thoroughly understands your plant and process requirements. The more thoroughly you brief them, the better they can advise you.

USE your capacity efficiently. Keep a close eye on your power factor; doctor it whenever economically feasible. See if you can reschedule some loads to get maximum utility from your demand. And remember, overpowered loads are just as inefficient as underpowered ones.

DON'T put off essential improvements because they appear too costly. Most modernization and expansion can be done one step at a time, starting at the incoming supply and working down as conditions and available capital permit.

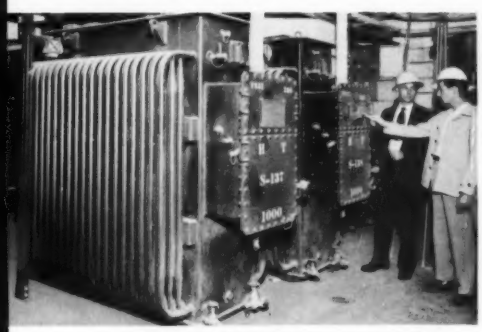
KEEP your management informed on your systems status and needs. Small annual charges for maintenance or expansion have a better chance of getting into the budget than one large item.

DON'T be unrealistic about your capacity requirements. Recheck your diversity requirements. Don't buy more than normal operation, with moderate spare capacity, warrants. Adequacy is judged by potential ability to expand, not by excessive installed capacity.



RADIAL OR NETWORK?

How planned development is helping San Antonio meet load-growth problems



B. Scholl, left, Underground Engineer, and W. F. Payette, Jr. Underground and Substation Engineer, inspect G-E network installation in downtown San Antonio.

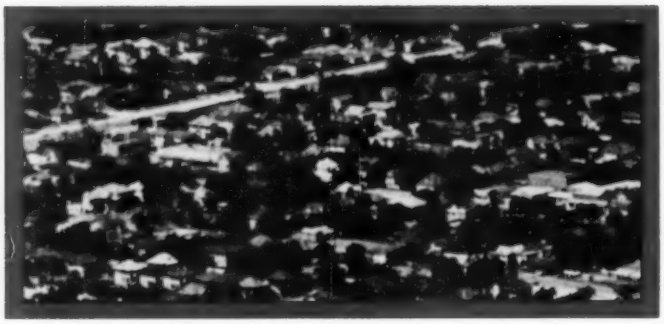
In a relatively short space of time, progressive San Antonio has become one of the major commercial and industrial centers of the Southwest. This rapid expansion, however, has created a continuing need for a flexible electrical system. The following pages show how the City Public Service Board is developing such a system and still maintaining stable power supplies.

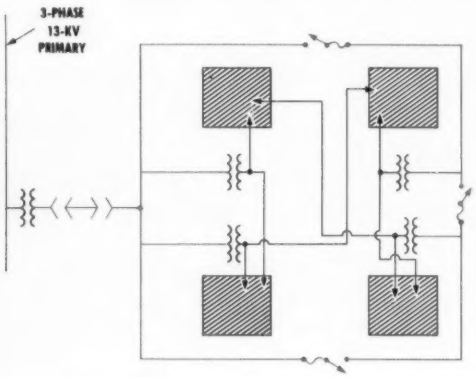
Progress Is Our Most Important Product

GENERAL ELECTRIC

San Antonio's long-range planning holds down

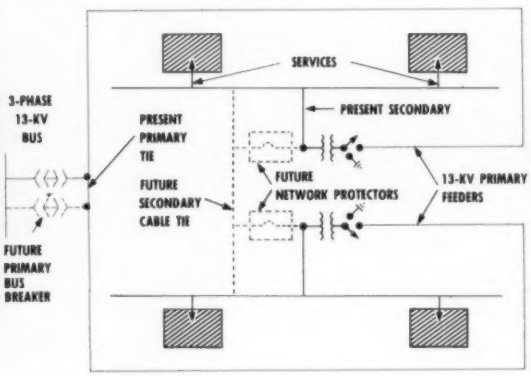
AREA 1 - RADIAL SYSTEM





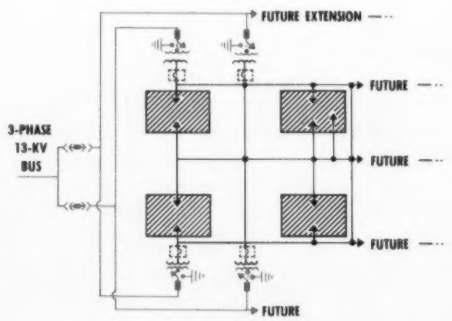
RED — PRIMARY
BLACK — SECONDARY, 208Y/120

AREA 2 - PARTIAL CONVERSION TO NETWORK SYSTEM



RED — PRIMARY
BLACK — SECONDARY, 208Y/120

AREA 3 - NETWORK SYSTEM



RED — NETWORK-SYSTEM PRIMARY FEEDERS
BLACK — NETWORK-SYSTEM SECONDARIES

cost of city's power-distribution system

City Public Service Board uses 3 systems to handle widely varying loads and to keep distribution costs to the minimum.

Radial System

San Antonio, like most U.S. cities, has large residential sections with relatively low load-concentrations. Area 1, served by a 4-kv overhead system, and now being converted to a 13-kv overhead system, is typical. The City Public Service Board finds this system adequate to handle the normal load growth for such urban residential areas. At the same time, the Board can provide for growth in such areas, currently zoned to restrict commercial and industrial expansion, by extending overhead feeders and by reinforcing substation facilities.

Partial Conversion to Network System

San Antonio also has areas where the load was too great for the existing overhead system but not concentrated enough to justify establishing complete network-system service. Area 2 is typical.

Formerly served by a 4-kv overhead radial system, the area is now being changed over to a partial network system. The new system uses 13-kv feeders and G-E network transformers. The transformers are being installed in underground vaults with cable connectors already on the low-voltage terminals. So it will be easy at a later date to add network protectors and convert to a complete network system. In the long run, the board will save considerable expense over reinforcing the old overhead system, the other alternative.

Network System

San Antonio also has central areas where the load density warrants a complete network system. Area 3 is typical.

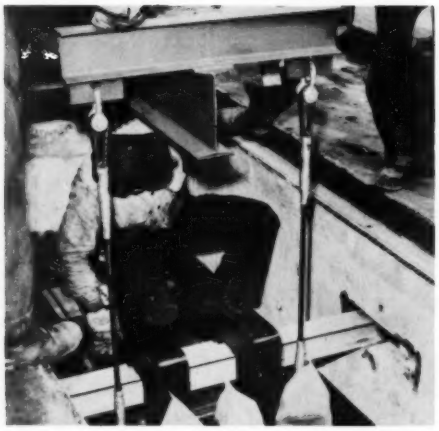
One of the earliest networks in the U.S., the San Antonio system was begun in 1929 with existing transformers to serve the concentrated load in the downtown area. Since then, the City Public Service Board of San Antonio has expanded the system to keep pace with the city's continued growth.

Cost of San Antonio's system, over the years, has been the minimum for two reasons: first, because the board started the system early; and second, because the board installs partial network systems, such as in Area 2, where growth will eventually warrant a complete network system. This keeps conversion costs low.

GENERAL ELECTRIC

For information on G-E network system equipment, see next page

You can save installation, operation and maintenance dollars with General Electric Network Transformers

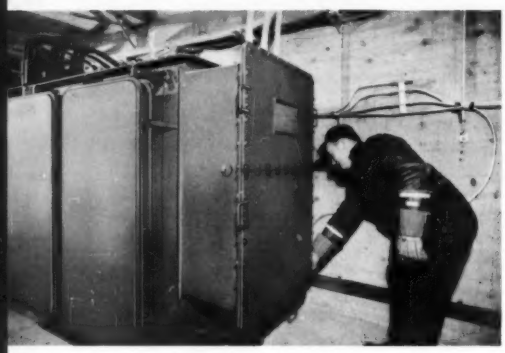


SUSPENSION MOUNTING

A new design concept, suspension mounting of low-height network transformers enables you to position a G-E network transformer in as little as ten minutes! Furthermore, corrosive elements such as sewage, dirt, and chemicals which collect in most vaults are *below* the transformer instead of around it. This drastically reduces tank corrosion and maintenance costs.

BALANCED THERMAL DESIGN

BTD was developed to control hottest-spot temperatures in General Electric network transformers. Here's what it can mean for you: *extra-long life* because transformer life is a function of hottest-spot temperature; *increased loading*, because units having BTD can better carry the severe loads normally encountered in network service; and *reduced size*, because, with BTD, G-E designers make the most efficient use of materials.



PANEL RADIATORS

G. E.'s new panel radiators increase reliability because there is less chance for leaks than with other designs—there are only eight entrances into the tank wall. There is less chance for corrosion to start because the smooth, vertical panels discourage the accumulation of dirt, moisture, and all types of corrosive elements. The new panels are also easy to clean and repaint.

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☐ I wish to talk to a G-E Sales Engineer about networks.

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GENERATION—Operation

Higher Current Densities Increase Brush Life*

H. L. SHERWOOD, Senior Hydro Engineer, Pacific Gas & Electric Co, San Francisco, Calif.

Operating life of commutators on exciters and collector rings on generators in hydroelectric plants are improved substantially by increasing the brush current densities. Specifically, current density should be maintained in a 40 to 55-amp-per-sq-in. range for commutators and collector rings.

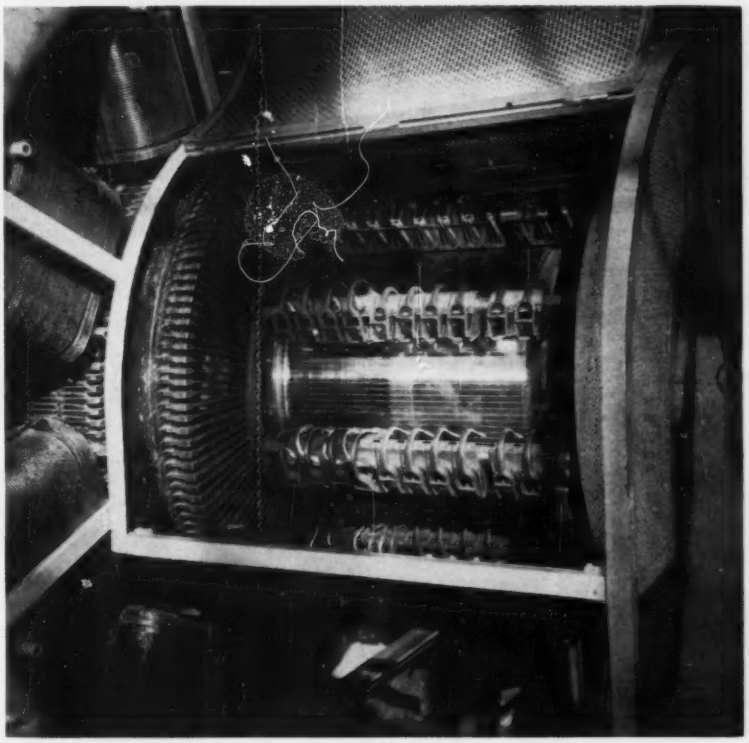
Better operational life also follows from the use of electrographitic grades of brushes rather than other grades. These conclusions were drawn after Pacific Gas & Electric Co surveyed the operational problems associated with brushes, commutators, and rings throughout its 58 hydroelectric plants, representing 97 exciters and 108 generators.

Article in Two Parts

The problem and its solutions are presented in two articles. Part I explains how to increase the brush life of commutators.

Among the conditions found by the survey were these: Very few commutators had a satisfactory film, and most of them were grooved. Almost every exciter was operating at loads of 40 to 70% of nameplate rating, with brush in-face current densities at maximum loads in the 15 to 30-amp-per-sq-in. range.

Adverse effects of this low-current condition can be predicted from a review of the relation between temperature and the coefficient of friction at the brush face. A cold brush has a high coefficient, which increases slightly to maximum value at about 75C. The coefficient drops to about one-third the maximum value at 80 to 85C. It remains almost constant until the temperature reaches about 120C, when it begins to rise, attaining about half maximum value at 140C.



ENOUGH BRUSHES are removed from the exciter for the hydro-generator to maintain brush-face temperature above 85C. Removals from arms are equalized

When brushes operate for extended periods at brush-face temperatures below 80C, excessive friction destroys any film and prevents the formation of a new film. With no film and excessive friction, brushes may become unstable in their holders, affecting commutation adversely.

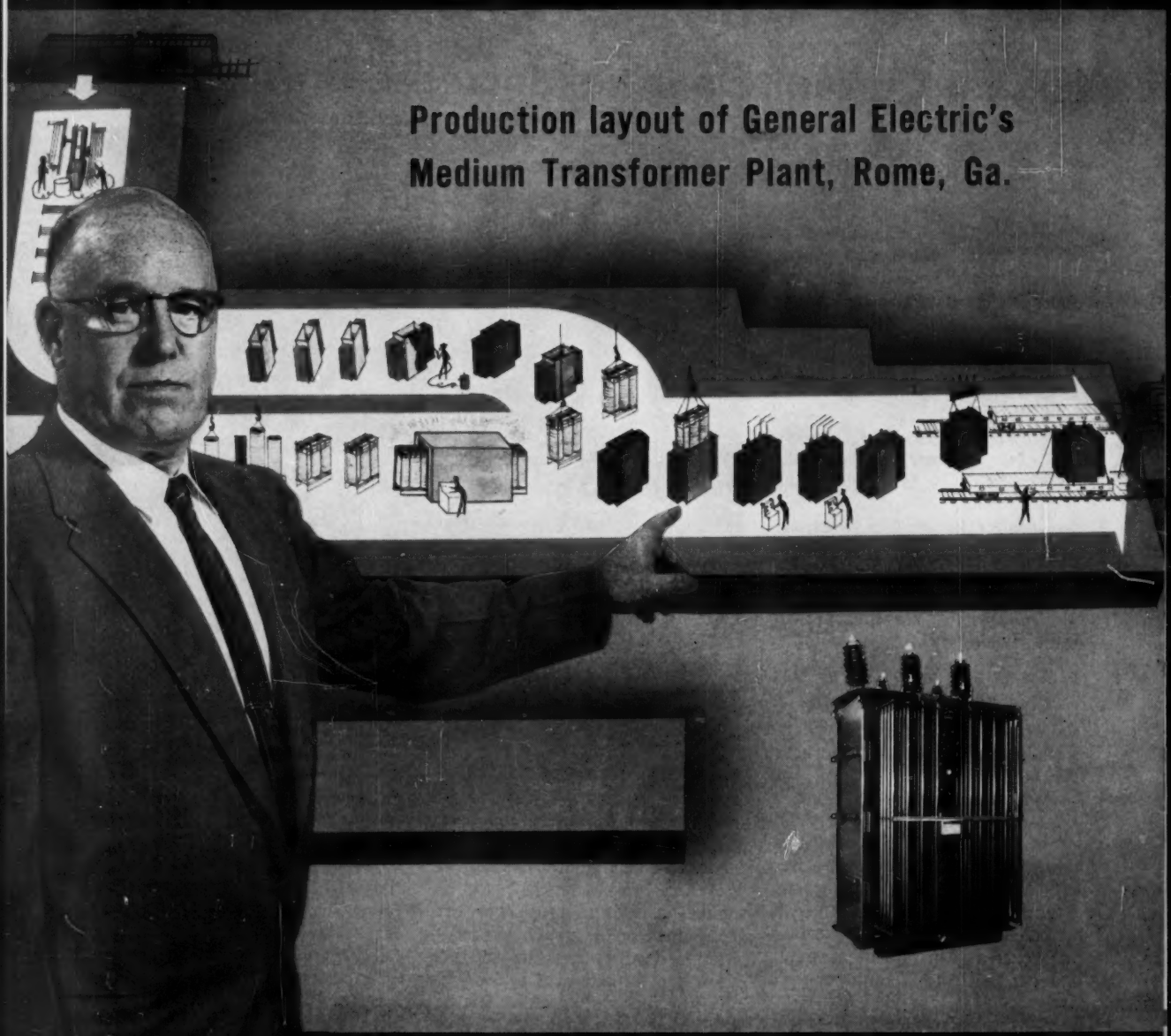
Densities Increased

It was apparent that the solution to the problem lay in increasing the brush current densities, especially during light-load periods, to maintain a brush-face temperature above 85C. Required brush current density was obtained by removing an equal number of brushes from each arm on the exciter. In the ensuing brush-removal program, brushes were removed from 86 of the 90 exciters inspected. Of the total of 3,188 brushes previously in use, 1,444 or 45.3% were removed.

Experience with the program soon revealed that it was unnecessary, and even undesirable, to remove brushes in a staggered pattern so that the full length of the commutator would be used. It proved difficult to secure a satisfactory pattern of brushes. It was found that a higher brush-face temperature could be obtained by using brushes across one end of the commutator. When only half or less of the commutator is used, there is the advantage of having the other half available for use later, thus doubling the commutator life. Brushes have been

(Continued on page 120)

* This article is in two parts, the first of which is presented here. Part II will appear in next's week's Electrical World.



Production layout of General Electric's Medium Transformer Plant, Rome, Ga.

MASS-PRODUCED TRANSFORMERS are a reality today on the assembly lines of General Electric's ultra-modern repetitive manufacture facility in Rome, Georgia. Manager of Manufacturing David Hopley predicts shipments of standard units from factory stock within 10 years.

A GENERAL ELECTRIC 10-YEAR FORECAST:

"Off-the-shelf" delivery of standard-design, automation-produced medium transformers

In 1967, electric utilities will be able to buy standard-design medium transformers direct from manufacturers' stock. This will permit immediate satisfaction of emergency load demands as well as shorter planning cycles for normal load growth. So forecasts David Hopley, manager of manufacturing at General Electric's Medium Transformer Department in Rome, Georgia.

This tremendous reduction in delivery time (from the present 10 weeks for standards, and up to 16 weeks and more for specials) depends on continuing the utilities' established trend to standard transformers. For, as acceptance of standard-design units grows, manufacturers are able to move toward automated production of "stock" medium transformers.

For instance, repetitive manufacture facilities at G.E.'s $25,000,000 Rome, Georgia, plant already have helped halve delivery time of medium transformers in the past 10 years.

YOU GET REAL BENEFITS *TODAY!*

During the transition period leading to entire systems of standard-design transformers, electric utilities are enjoying current benefits from General Electric medium transformers. For example:

Lower price—Standardization of design results in an 8% saving in price on General Electric RM (Repetitive Manufacture) medium transformers.

More and better features—Standard design makes it economically possible for G.E. to offer such extras as Formex* insulated windings, control-center arrangement of instruments and accessories, reversible junction boxes, and many others.

Higher quality for longer life—G-E repetitive manufacture techniques permit 18 assembly-line tests and 22 quality-control inspections during manufacture, to assure dependable operation over a long service life.

G.E.'S BROAD RANGE OF STANDARDS HANDLES 90% OF ALL JOBS

If your company is not yet taking full advantage of the large dollar savings and other key benefits of medium transformer standardization, act today. Ask your G-E Apparatus Sales Engineer to show you how G.E.'s broad range of standard RM medium transformers can meet the large bulk of your needs, and also work efficiently with older, special transformers now on your system. General Electric Co., Schenectady, N. Y. 416-10

*Reg. Trade-mark of General Electric Company.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Increase Bushing Life

(Continued from page 117)

removed from both new and badly worn commutators with no trouble from differential heating.

Whenever possible, brush current density during times of maximum loadings should be sufficiently high so that the density during minimum loading will be at a level that will prevent serious deterioriation of commutator films. Sufficient brushes are removed so that those remaining carry 50 to 55 amp per sq in. during normal maximum load conditions. It has been found that brushes carry up to 80 to 90 amp per sq in. under limited abnormal conditions without distress.

It is not always possible to remove the required number of brushes to meet load conditions. On exciters where removal of all but one brush per arm does not provide the required current density, it may be necessary to plug each end of the brush holders and reduce the brush width. In one instance, a single row of cut-down brushes is used during the winter months when exciter load is low. A single row of full-size brushes is used during the summer when exciter load is at the maximum. The exciter normally used three rows of brushes.

Help Set Up Film

One practice helps to establish a new film on new or reconditioned excited commutators or on commutators having a brush current density so low that the film forms slowly. Grooves or slots are cut diagonally across the brush faces. The current density is increased in proportion to the brush face area removed. By the time the brush wears down to the depth of the slot, a good film usually has formed. Where several exciters supply a common bus, it may be possible to shut down one machine to increase the brush current densities on the remaining exciters.

It has been PG&E's practice to purchase exciters rated considerably in excess of the capacity of the generator fields they supply. As a result of the field survey, exciter specifications will be changed so that regardless of the exciter's capacity, the manufacturer will furnish the proper number of brushes to meet the current requirements of the generator field. This practice should eliminate the less satisfactory solution of removing brushes and/or modifying or replacing brush holders in the station.

First of Two Articles

Part II, covering the results obtained by removing brushes from collector rings and using electrographitic grades of brushes on exciters and rings, will appear in the next issue of Electric World.

DISTRIBUTION—Testing

Procedure Applies Two Test Voltages Simultaneously

O. E. MONTGOMERY, Standards Laboratory, Detroit Edison Co, Detroit, Mich.

Detroit Edison Co has minimized the test handling of instrument transformers by applying two test voltages simultaneously.

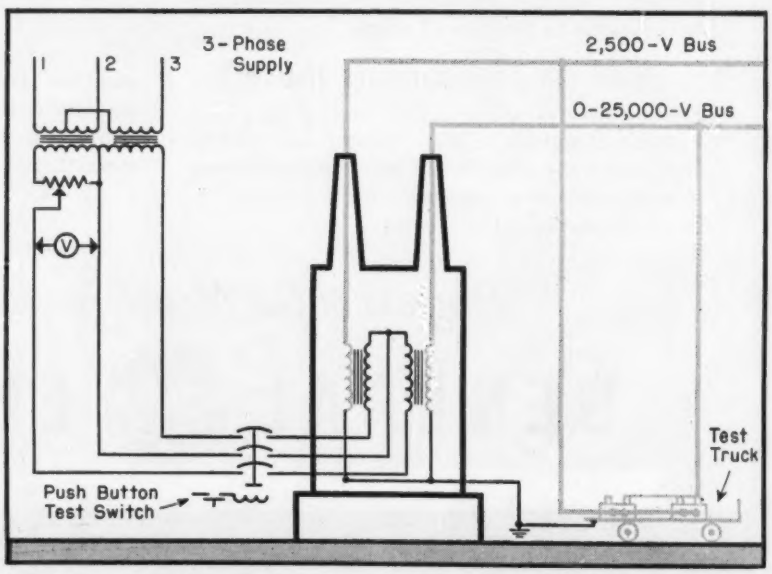
Transformers, when placed on a truck with a metal covered platform, are tagged and listed, and the truck is moved to the high-potential cage of the standards laboratory.

The zero or ground connection of the hipot test set is connected to the metal platform of the truck establishing ground to all the transformer bases and cores simultaneously.

Then the instrument transformer primary terminals are connected together by a small link chain by laying the chain on or winding it around the primary terminal. The chain is then connected to the high-potential bus.

The instrument transformer secondaries are connected by means of a multi-tapped lead which, in turn, is connected to the 2,500-v bus supplied by the test transformer unit. This 2,500-v source is a transformer contained in the tank as the main test transformer. Its supply voltage is in quadrature with the main transformer supply and is not adjustable. The two test voltages are supplied simultaneously. The schematic arrangement is illustrated.

After completion of the hipot test, the transformers are given the normal polarity, ratio, and phase-angle tests, and then returned to the stockroom.



SCHEMATIC shows how dielectric tests are applied to both windings simultaneously on instrument transformers grouped on truck in standards laboratory

Plates from REVERE for a BIG JOB

by C. H. WHEELER

Here you see two rolled Muntz Metal condenser plates, being drilled simultaneously in the plant of the C. H. Wheeler Manufacturing Co., Philadelphia 32, Pa. The plates were supplied by Revere. They measure 100-¾" x 203-¾" x 1-½" thick. Four plates were supplied for a Wheeler 2-pass divided water box unit having 95,000 sq. ft. of condensing surface. The overall length of the condenser, including water boxes, is 48 ft., and overall height, including steam dome and hot well is 34 ft.

Revere is an important supplier of plates and tubes for condensers, heat exchangers, and similar equipment, shipping to all parts of the country. Collaboration on alloy selection and specification is freely available. Just get in touch with the nearest Revere Sales Office.

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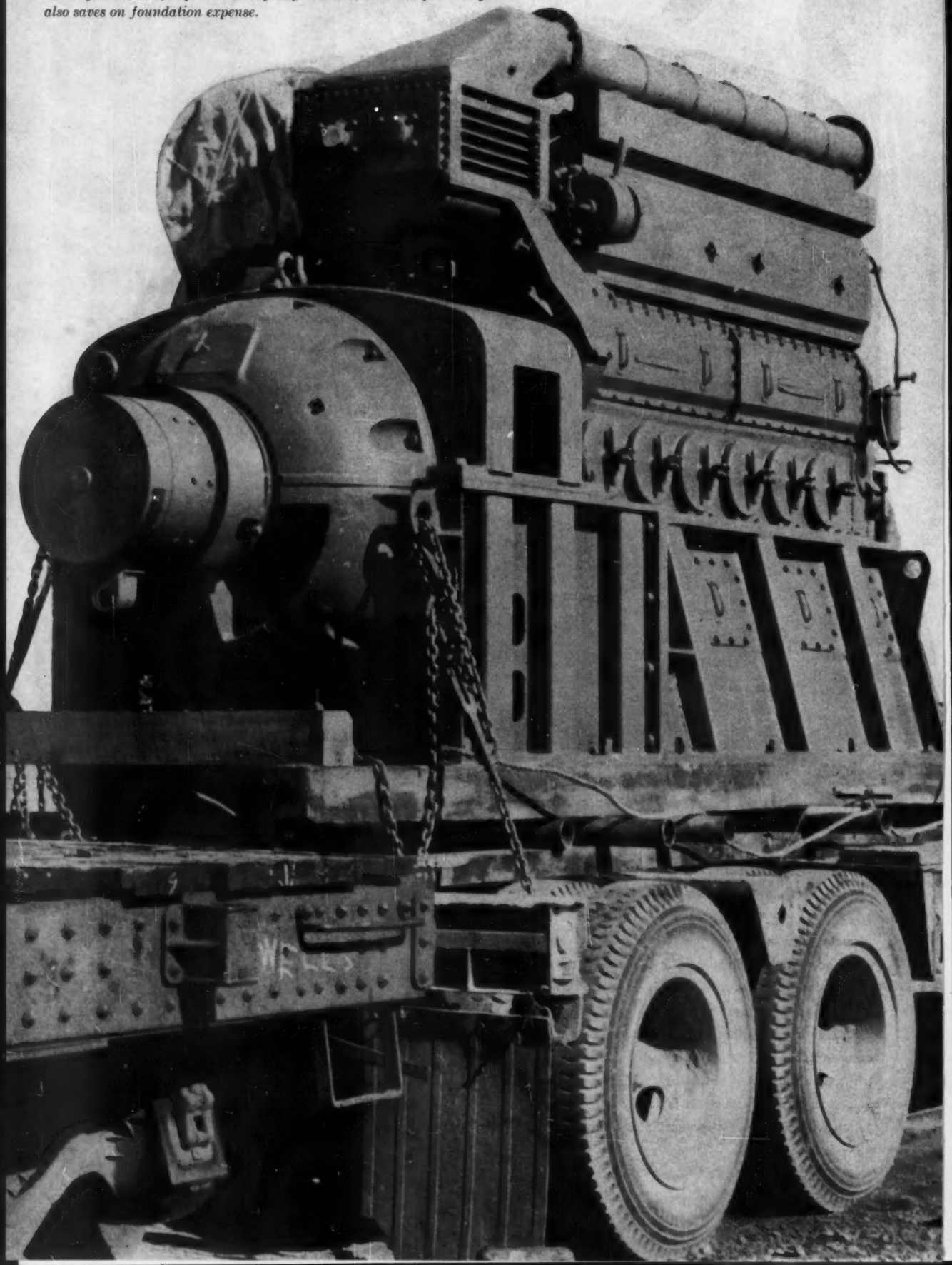
500 KW IN ONE PACKAGE. *This "unitized" engine generator shipped already assembled, requires no aligning at the site. Its compact design also saves on foundation expense.*



1957 POWER!

Long famed for reliability, Worthington 1957 power engines have many new features that can help you produce permanent or standby power at the lowest costs ever achieved for real *heavy-duty* units.

LOWER INSTALLATION COSTS—The new SW 9 engine you see at left has been **"unitized"** with its generator to drastically cut space requirements, installation time and expense. This design requires no aligning at the site. Should needs ever change, the entire unit can just as easily be picked up and moved to another location.

LOWER FUEL COSTS—In 1957, Worthington is pioneering in power by designing and building engines *specifically* for turbo-charged operation. The SW 14, for example, is America's first high output diesel built only for high pressure turbo-charging.

For economy today *and* tomorrow, all '57 Worthington power engines can be furnished to run on the lowest cost, locally available fuels—residual, crude, and distillate oils; natural, sewage, propane or manufactured gas.

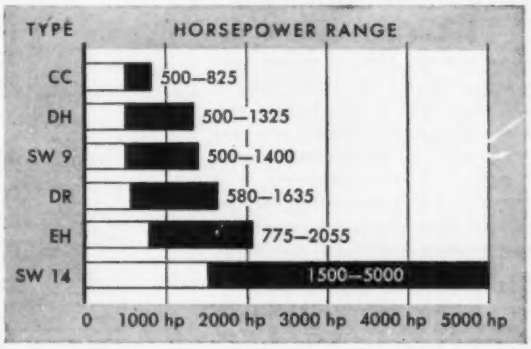
LOWER MAINTENANCE COSTS—With Worthington's 1957 engine line, you enjoy the economy of modern power design plus amazingly low maintenance. One of the many maintenance-saving features of the new SW 9, for example, is the Jet Swirl combustion chamber. The chamber is designed so that the air swirls as it enters the cylinder assuring rapid mixing of air and fuel for extremely clean combustion giving longer valve and liner life, as well as ultra-efficient operation.

The fact that every upper mechanical part is within reach from the operating level is another maintenance saving feature.

For reliable power in the 500 to 5,000 hp range, at the lowest possible cost, get in touch with your nearest Worthington District Office. Worthington Corporation, Harrison, N. J. In Canada: Worthington (Canada) 1955, Ltd., Toronto, Ont.

E.7.1

Choose your next diesel from Worthington's complete line of heavy-duty four-cycle power engines.

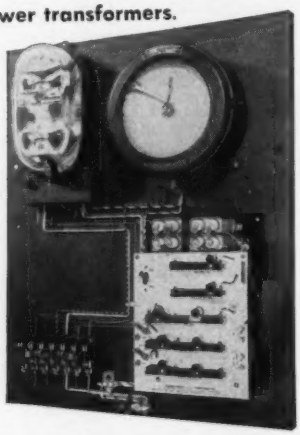


WORTHINGTON

Transformer Loss Compensator

Saves you Money!

BECAUSE it provides an accurate means of measuring the energy and demands of high-voltage services at the low-voltage side of the power transformers.



This installation at 2.3 kv saved about $2600 compared with 34.5 kv metering; it saves about $5500 over metering at 69 kv.

THE TESCO compensator adds to the registration of the watthour meter an amount equal to the sum of the iron and copper losses of the transformer bank. It may be used with practically any type of watthour meter and . . . importantly . . . no changes are made in the meter itself, either structurally or in adjustments . . . It is produced in two and three element types for use with two-element or three-element meters on any type circuit.

Some of the Users . . .

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Pole Location Aided by Index

F. S. HALL, Ohio Power Co, Canton, Ohio

When pole-location numbers were originally assigned and the locations posted on Ohio Power Co maps, the numerical sequence gave their relative positions. As poles were added and removed, assignment of numbers could not be made to show actual sequence. Accordingly the task of locating pole numbers became time-consuming on most of the company's maps.

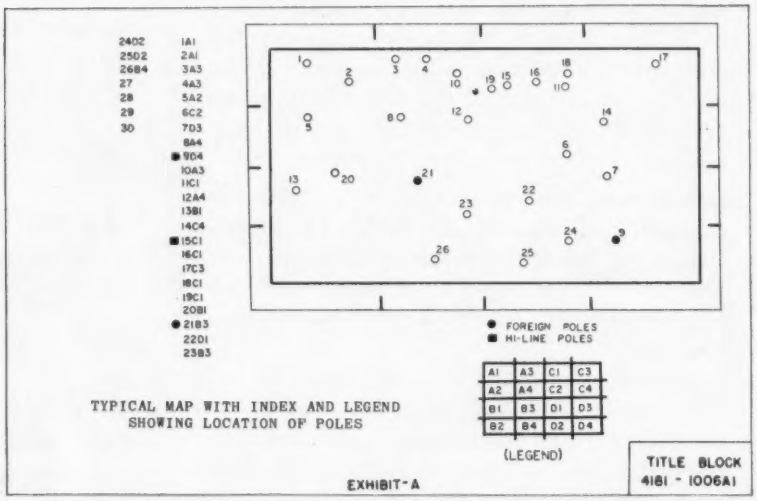
To reduce the time for locating poles, the company devised and is now using a locating-index similar to that on most State highway road maps. This index is part of the map-title block. The suffix on each number is used only in the index and is not added to pole numbers.

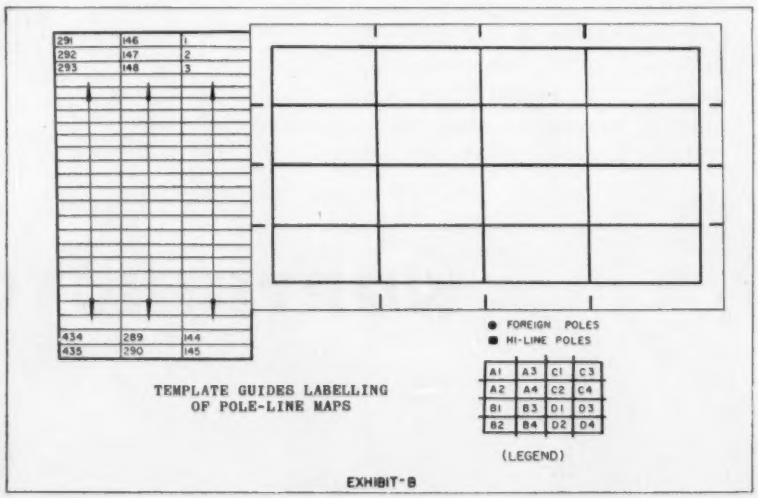
On the left-hand margin of the maps are listed pole numbers in numerical order. Suffixed to each pole number in this list is a symbol denoting one of the 16 sections in the map, such as A1, B3, C2, and D4 in Fig. 1. The suffix indicates the section of the map in which the pole is situated.

As an example, in Fig 1 pole 8, which can be any one of 400 poles, can be located readily by its suffix A4, which indicates Section A4 of the map.

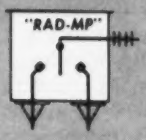
Locating a pole now takes about $\frac{1}{16}$ the time used without the index. The index can be expanded to in-

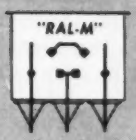
(More How To on page 126)

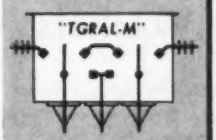


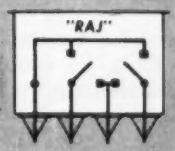


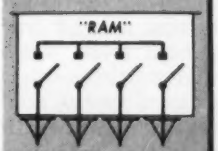
TYPE "RA" OIL SWITCHES ARE MADE IN VARIOUS FORMS TO MEET INDIVIDUAL REQUIREMENTS.











AVOID COSTLY SHUTDOWNS

in large industrial plants by providing cable system F-L-E-X-I-B-I-L-I-T-Y

with G&W Type "RA" *Load Break* OIL SWITCHES

Adequate flexibility has become very important in recent years as the use of underground cable systems has increased. While outages on cable systems are infrequent, the length of time on such outages may be long enough to cause considerable inconvenience.

With "RA" switches located at strategic points in cable circuits to provide flexibility, a system can be so arranged that important loads will have an alternate source of power immediately available.

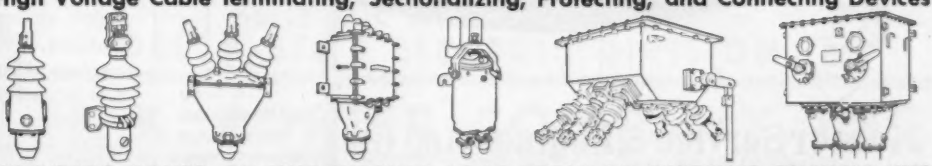
Since their introduction in 1928, Type "RA" switches have had a trouble-free operating record which fully justifies their use as load break disconnects for single or multiple circuits. They are safe and reliable, combining simplicity with economy in construction, installation, and maintenance. They will operate properly after long periods of inactivity to provide fast and convenient isolation of cable sections in case of trouble and to permit rapid rerouting of circuits to materially reduce losses normally incurred through electric service interruptions. Exposure to weather extremes or complete submersion for prolonged periods will not affect prompt and safe operation when necessary. They are water-, oil-, and air-tight.

Send for series "D" bulletins.

G&W ELECTRIC SPECIALTY COMPANY
3500 W. 127th ST., BLUE ISLAND, ILLINOIS D573

Representatives in many cities of U. S. A., N. & S. America — Canadian Mfr. – Powerlite Devices, Ltd., Toronto, Montreal & Vancouver

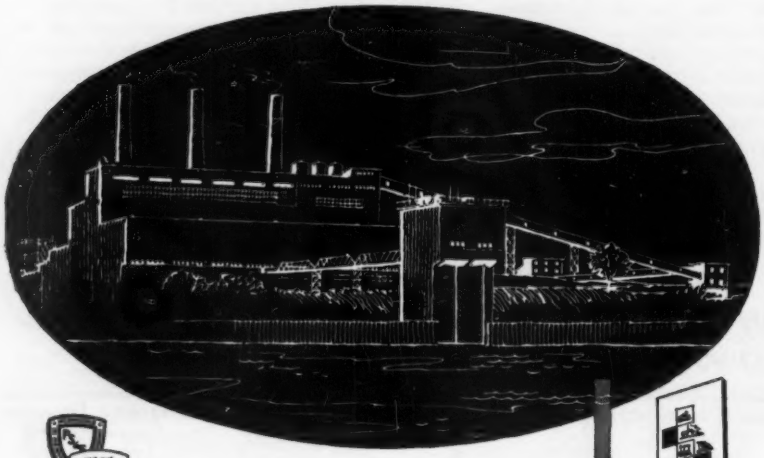
High Voltage Cable Terminating, Sectionalizing, Protecting, and Connecting Devices



POTHEADS • BOXES • OIL FUSE CUTOUTS • LOAD BREAK OIL SWITCHES • SPLICING KITS

PUTTING **POWER** INTO
YOUR EXPANDING PROGRAMS

ATOMIC, HYDRO and FOSSIL FUEL POWER PLANT DESIGN
FOR INDUSTRIALS and UTILITIES



55 YEARS

Pioneer Service & Engineering Co.

231 South La Salle Street • Chicago, Illinois

Send for our descriptive booklet, "Pioneering New Horizons" of these and other services.

Helps Locate Pole

(Continued from page 124)

clude such items as foreign poles, transmission poles, etc., by prefixing an appropriate symbol.

The legend and the heavy, short, solid lines along the border of the maps serve as a guide to the section number.

To expedite the mechanics for setting up the procedure, two tracing templates, one for the index and the other for denoting section lines, are combined as in Fig 2 for labeling the 24 x 36-in. prints. The template for the index column contains pole numbers in numerical order. The template for section lines shows the border marks and also the section lines explained in the legend.

The company's experience definitely indicates that this procedure for locating poles saves considerable time, as well as avoiding confusion, and greatly offsets the time of initiating a locating procedure.

DISTRIBUTION—Construction

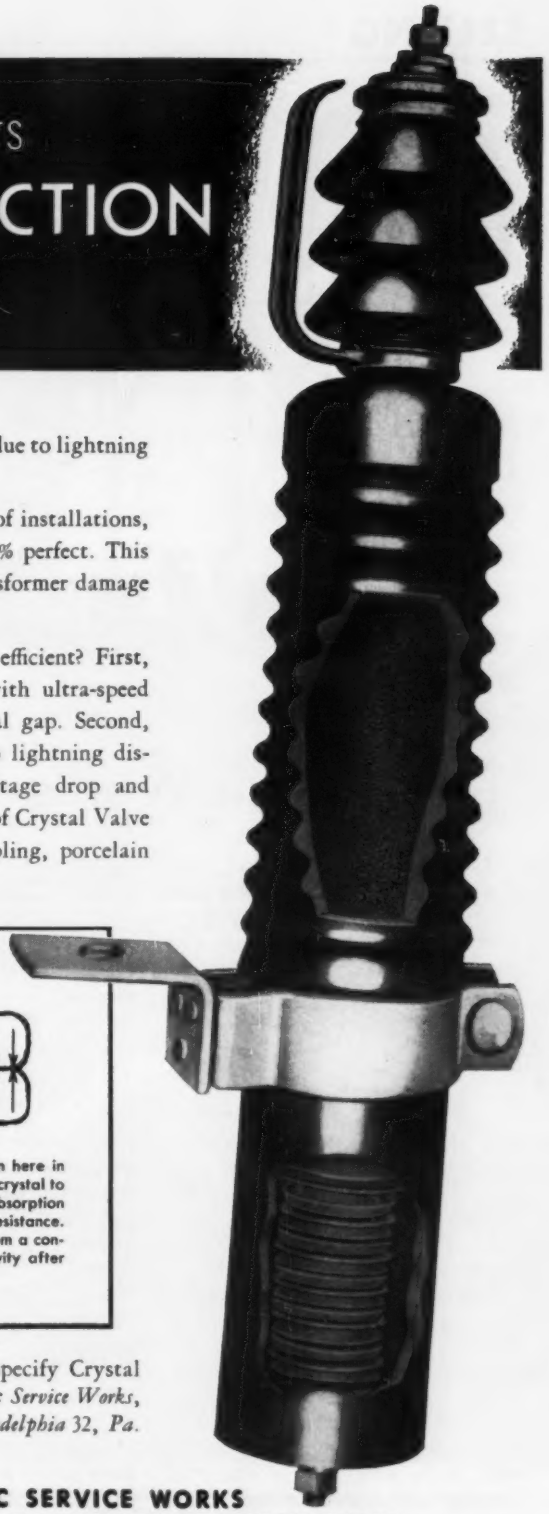
Special Wrench Tightens Washers

MAX WINDWEHEN, Working Foreman, Plains Division, Southwestern Public Service Co, Plainview, Texas

A special wrench for tightening "wagon wheel" washers in double crossarm assemblies eliminates personal injuries and broken tools for Southwestern Public Service Co. The wrench was devised for the job by the author because no other type of wrench has been found which tightens the washers satisfactorily.

The wrench has a special head welded to a steel shaft. The head is cut for a close fit over the raised portion of the washer. In the past a screw driver used to tighten the washers, often broke, or slipped out, causing skinned knuckles. The special wrench was made in the Plainview shop of Public Service. All crews in the Plains Division will soon be provided with it.

How Crystal Valve Arresters
INCREASE PROTECTION
against line lockouts

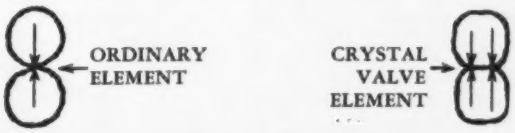


You may readily increase protection against line lockouts due to lightning —simply by using Crystal Valve Arresters.

Results of a 17-year service check, covering thousands of installations, show that Crystal Valve Arresters rated better than 99% perfect. This means virtual elimination of power failures or costly transformer damage due to lightning.

What makes Crystal Valve Arresters so remarkably efficient? First, they provide split-second reaction against lightning, with ultra-speed multiple arcing unit coordinated with isolating external gap. Second, oxidized silicon carbide crystals automatically adjust to lightning discharges—from mild to severe—with minimum IR voltage drop and ample surge voltage reduction. Third, moisture-proofing of Crystal Valve Arresters is complete—with solid brass closed-end coupling, porcelain cap and duplex seal at ground end.

SEE THE DIFFERENCE IN CRYSTAL VALVES



Oxidized silicon carbide crystals in Crystal Valve arresters (shown here in highly magnified form) are shaped to establish multiple contacts from crystal to crystal—instead of single contacts. This means faster, more positive absorption of lightning discharges. At normal voltages, this element has very high resistance. Under lightning surge, the oxidized silicon carbide crystals change from a condition of high resistivity to high conductivity, returning to high resistivity after the surge has passed.

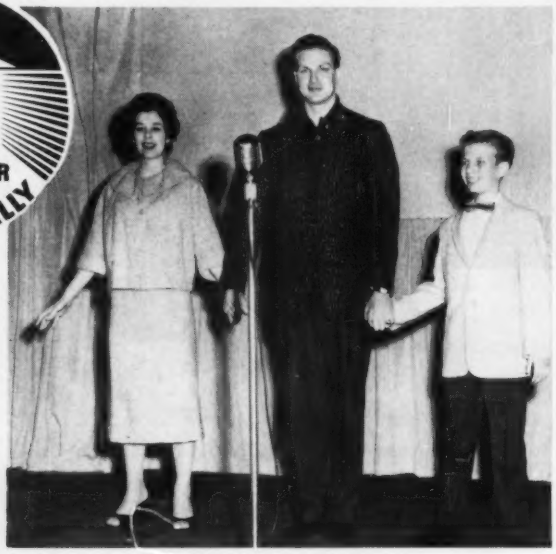
Get the complete benefits of this proved protection. Specify Crystal Valve Arresters for all your power line equipment. *Electric Service Works, Delta-Star Electric Division, H. K. Porter Company, Inc., Philadelphia 32, Pa.*

HKP

ELECTRIC SERVICE WORKS
DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.

Divisions of H. K. Porter Company, Inc. are: Alloy Metal Wire, Connors Steel, Delta-Star Electric, Henry Disston, Laclede-Christy, Leschen Wire Rope, McLain Fire Brick, Quaker Pioneer Rubber, Quaker Rubber, Riverside Metal, Vulcan Crucible Steel, W-S Fittings.



'Live Better Electrically' Comes Alive at EEI's . . .

'Three Magic Words' Show

Live Better . . . Electrically ideas for the Spring sales season, and plans for the Fall were given a dramatic boost at the recent EEI Sales Conference in Chicago in "Three Magic Words," a half-hour musical presentation that highlighted the conference's final luncheon.

It opened with the residential sales manager of the electric utility serving "Everytown, U. S. A.," discussing the business situation with the town's leading builder, electrical contractor and appliance dealer. Each put forth his Spring promotion plans. Then with blackouts and slides, recent Live Better Electrically promotions were brought to life, and the businessmen explained how they tied their own plans into these. The importance of utility leadership was underlined again and again in the first part of the show.

The second part of the presentation hit home on the need for a long-range residential promotion program such as Live Better Electrically. Comparative figures on how much was spent to push the goods and services of other industries and the electrical industry were cited. The picture is not very encouraging. The liquor business gets more of the disposable income in the U. S. than does the electrical industry . . . but is there any question about their relative *importance* to the comfort, health and living standard of the American people?

The show ended with a dramatization of the Live Better Electrically seal, bringing it to life with Everytown's typical father, mother and son (see illustration), and a rundown of the LBE's fall advertising and promotion materials, including the new "rate yourself" ads, TV spots, and Publisher's Auxiliary supplement. These will be in utility hands by September.

EEI Slates Comm Cooking Confab for May in Chicago

This year's Commercial Cooking Conference will be held at the Sheraton Hotel, Chicago on May 7th.

Sponsored by EEI's Commercial Cooking and Water Heating Committee, the conference is held annually during the week of the National Restaurant Show and other food service industry meetings.

The program has been slanted to help those promoting commercial cooking and water heating. Featured topics include: "The Demonstration and Exhibit Bus," Commercial Cooking Open House Demonstration, "Restaurant Idea Round-Up No. 3," "Equipment Cost Comparison," "Use of Company Cafeterias for Demonstration Purposes," "History of Electronic Ovens in Detroit," and "How to Calculate Hot Water Requirements."

Adequate Wiring for A.C.

Kansas Gas & Electric Co has recommended to dealers that, before closing any sale of a 115 volt, one horsepower window air conditioner, the dealer should carefully analyze the customer's house wiring to determine whether the electrical circuit to the air conditioner location can handle the unit in extreme hot weather. If not, a 230-v circuit may be cheaper in the long run.

NEMA Unit Plans Push on Dishwashers

The Household Sink Units Section of NEMA has planned a nationwide electric dishwasher promotion for utilities. Reason: Sales in '57 are expected to top those in '56, when they were 35% ahead of 1955. This contrasts sharply with the rest of the appliance prediction picture.

A special merchandising kit has been mailed to 750 executives in 250 utilities. Kit includes an 8-page newspaper supplement, a dealer flipover, streamer and consumer brochure and excerpts from successful local dealer promotions.

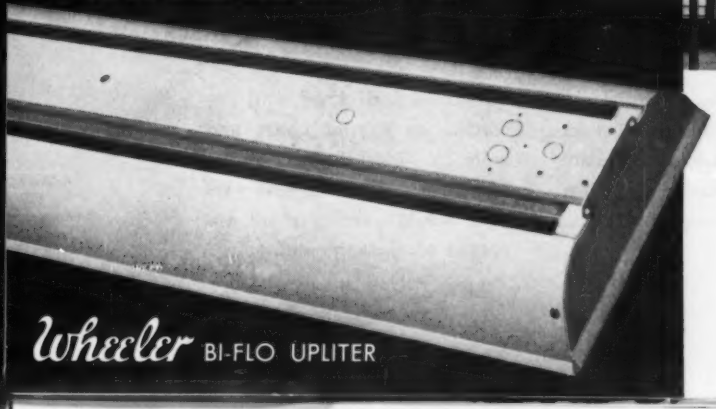
(More Selling on page 132)

Wheeler

"PACKAGE PLAN" LIGHTING

the efficient, time-saving way to solve <u>all</u> your lighting requirements <u>at one time!</u>

Fluorescent — Incandescent — Specialized Lighting . . . most jobs require not just one but various combinations of these modern forms of industrial lighting. When you submit your requirements to Wheeler Reflector Company, one quote does it. No need to split your requirements or to locate sources for each type. One quote! One source! One standard of quality for over 75 years!



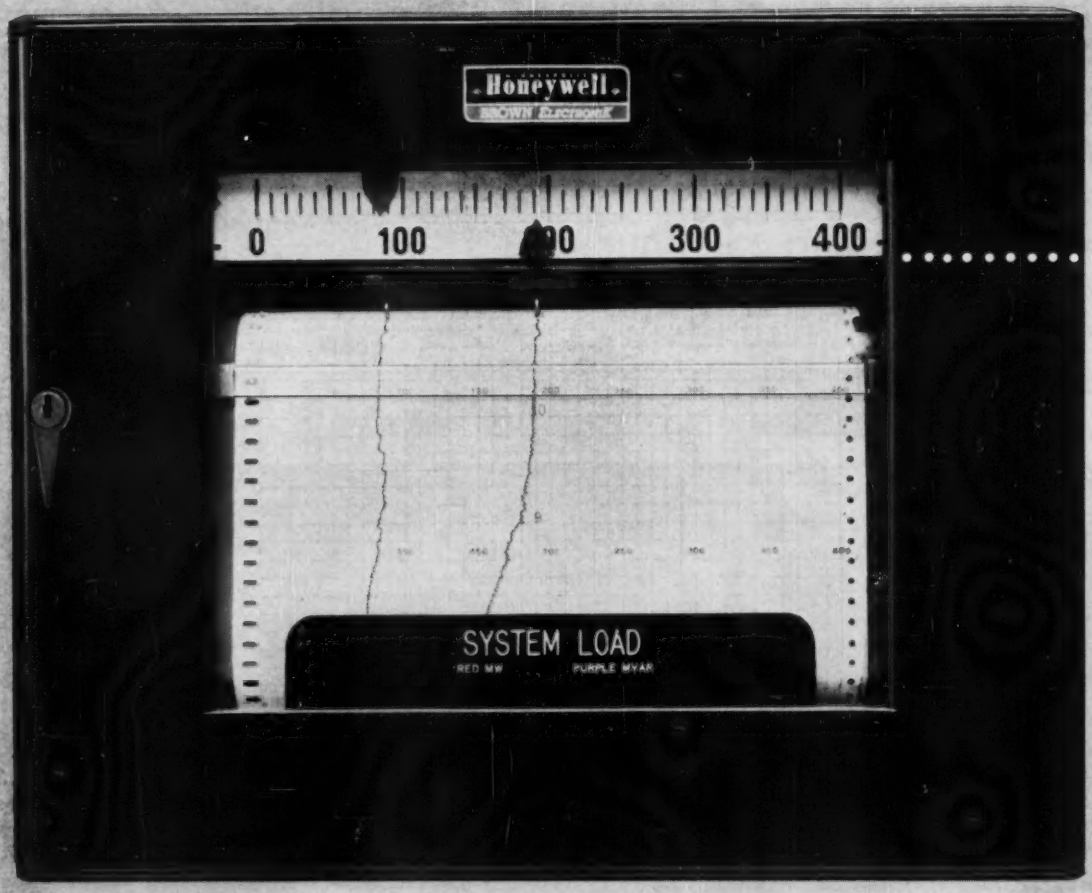
Wheeler "PACKAGE PLAN" Lighting as installed in plant of *Tracerlab* Inc. Pioneer in the Nuclear Industry

Wheeler Reflector Company

DIVISION OF FRANKLIN RESEARCH CORP.

275 Congress Street, Boston 10, Mass.

Distributed Exclusively through Electrical Wholesalers



choose from three different ways to record load data:

1

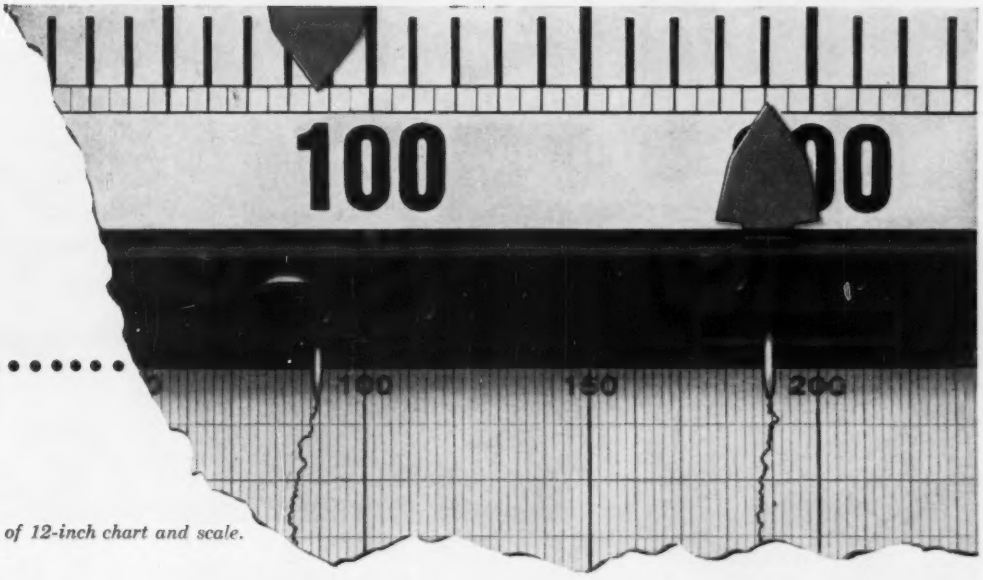
both variables on a single chart and scale calibration; recorded in inks coded to match dual pointers (for the two-pen model illustrated above).

2

both variables recorded on the same chart, with dual scale calibrations that read watts and vars in the most convenient range for each.

3

variables indicated and recorded on a split chart and scale . . . ideal for combining four records of watts and vars that would overlap if all appeared on the same chart.



Actual size section of 12-inch chart and scale.

Watts and Vars at a glance ...on ONE instrument

The accurate, time-saving way to check watts and vars is to see them on the same *ElectroniK* instrument. One instrument does the job of two . . . needs only half the panel space, half the chart paper.

You can have watts and vars recorded in the way most convenient for your particular needs. Both values can be indicated and recorded *continuously*, by a two-pen model. Or, a single-pointer instrument can *alternately* print watts and vars.

Either way, you're sure to profit by the accuracy, dependability, and serviceability for which *ElectroniK* instruments are famous, in power plants and industrial installations everywhere. Ask your local Honeywell sales engineer to talk over your specific application . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

● **REFERENCE DATA:**
Write for Bulletin 9070, "Instruments for Electrical Power Generation."

H HONEYWELL

MINNEAPOLIS **Honeywell**
BROWN INSTRUMENTS
First in Controls

For "small-job sealing"...

Johns-Manville

Duxseal

in the new handy pocket roll

THE NEW HANDY pocket roll makes Duxseal® ideal for small sealing jobs in both installation and maintenance work. It thereby increases the usefulness of your favorite all-purpose sealing and caulking compound.

The NEW pocket roll container allows quick removal and replacement of the compound. Its ribbon form makes Duxseal easy to apply in any amount, large or small.

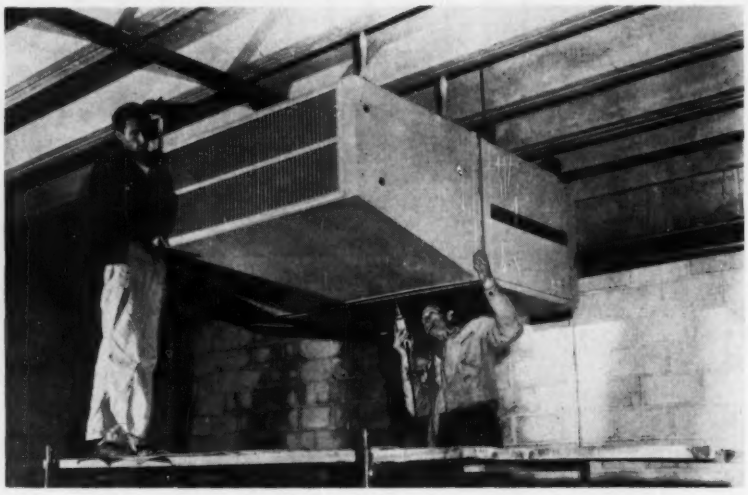
3 types of Duxseal are now available in pocket rolls:

- **STANDARD DUXSEAL** is a permanently plastic gray-green compound utilizing a non-drying, vegetable-oil vehicle. It will not corrode metals, plastics, wood, rubber, or painted surfaces. It adheres well to all common materials. It is non-staining.
- **TYPE N DUXSEAL** has the same properties plus higher resistance to bleeding or dripping at high temperatures.
- **R-100 DUXSEAL** employs a resinous material as its vehicle and has the same properties. It skins fast to provide an excellent paint surface.

A wide range of other J-M Sealing Compounds is also available in pocket rolls. These are described in sheet EL-85A. Duxseal is covered in sheet EL-68A. Write Johns-Manville, Box 14, New York 16, N. Y.

Johns-Manville

DUXSEAL



Dallas Mart Installs 105 A.C. Units

Workmen are shown installing General Electric packaged air conditioning units in the new $6½-million Dallas Homefurnishings Mart. The job is said to be the largest single application of horizontal air conditioning units in the world.

The units—there are 105 of them—both heat and cool 434,000 sq ft of floor space. Installed in 7½, 5 and 3-ton models, they add up to some 600 tons of air conditioning.

Big reason for using packaged units was flexibility. Individual area control is reported better than with a central system.

West Penn Will Push Heating in '57

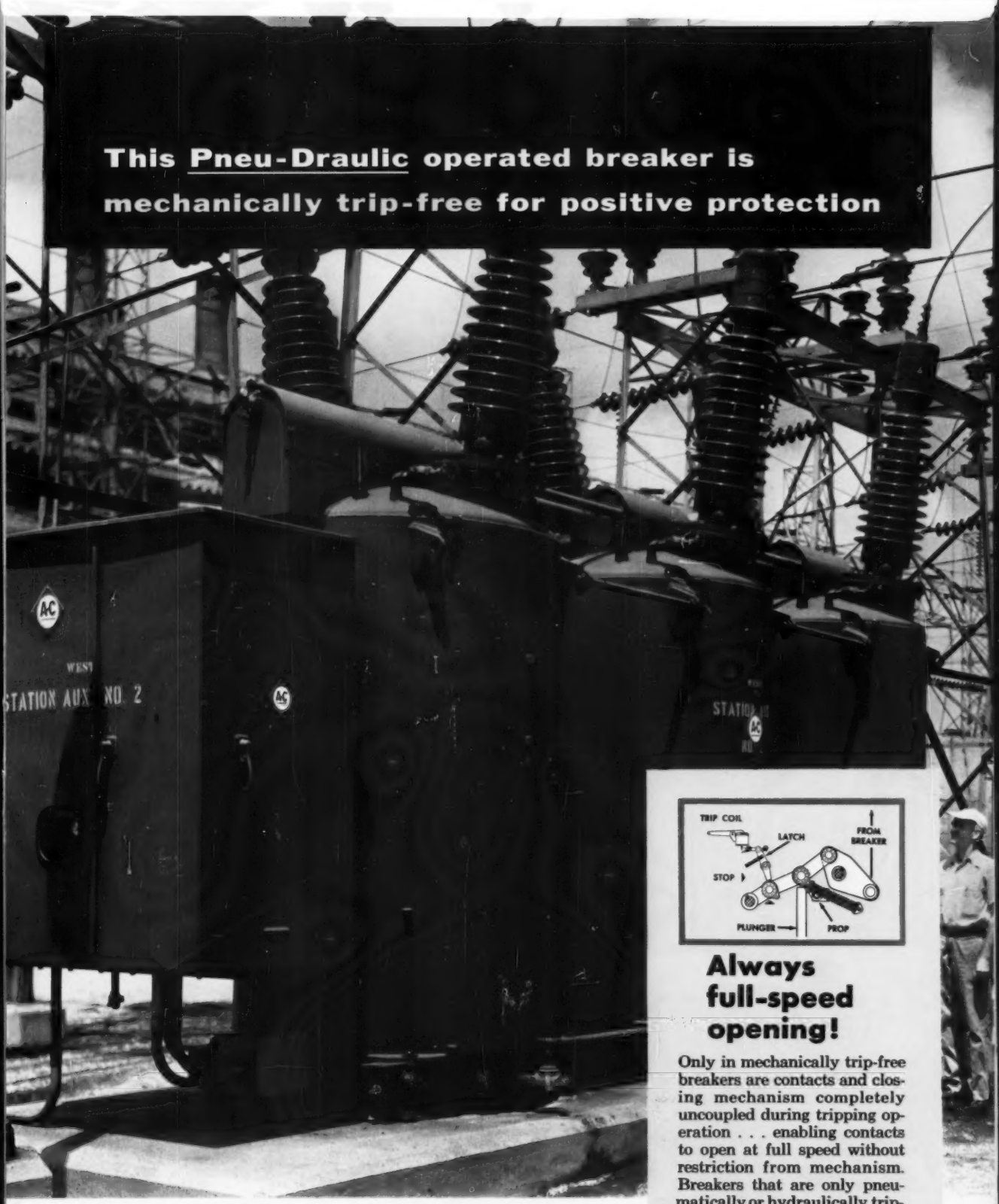
Interest in electric home heating is picking up in Pennsylvania. West Penn Power Corp recently published announced plans to push it in 1957. Here are the highlights around which program is built:

- Sponsor training meetings for dealers and other interested people.
- Help electric heating dealers plan their installations. Assist them in advertising, promotion and equipment sales.
- Programs for interested groups on electric home heating.
- Conduct cost-of-operation studies on existing installations.
- Work with builders promoting model homes having electric heat.
- Furnish heating equipment for shows and displays, including a special working model of a heat pump.
- Distribute Home Planning Idea Kits featuring electric heating. These will go to customers who are building or remodeling.
- Publicize electric heating in House magazine going to 325,000 residential customers.
- Keep builders, architects, electricians and other interested people informed of new electric heating developments through direct mail pieces.

Washer No. 1 Seller

Top spot in appliance sales went to the automatic washer in 1956, according to Murry Corp. About 4½ million units were sold. This is the first time any appliance has replaced the refrigerator as the number one national seller.

(More Selling on page 135)



Always full-speed opening!

Only in mechanically trip-free breakers are contacts and closing mechanism completely uncoupled during tripping operation . . . enabling contacts to open at full speed without restriction from mechanism. Breakers that are only pneumatically or hydraulically trip-free cannot give you this protection.

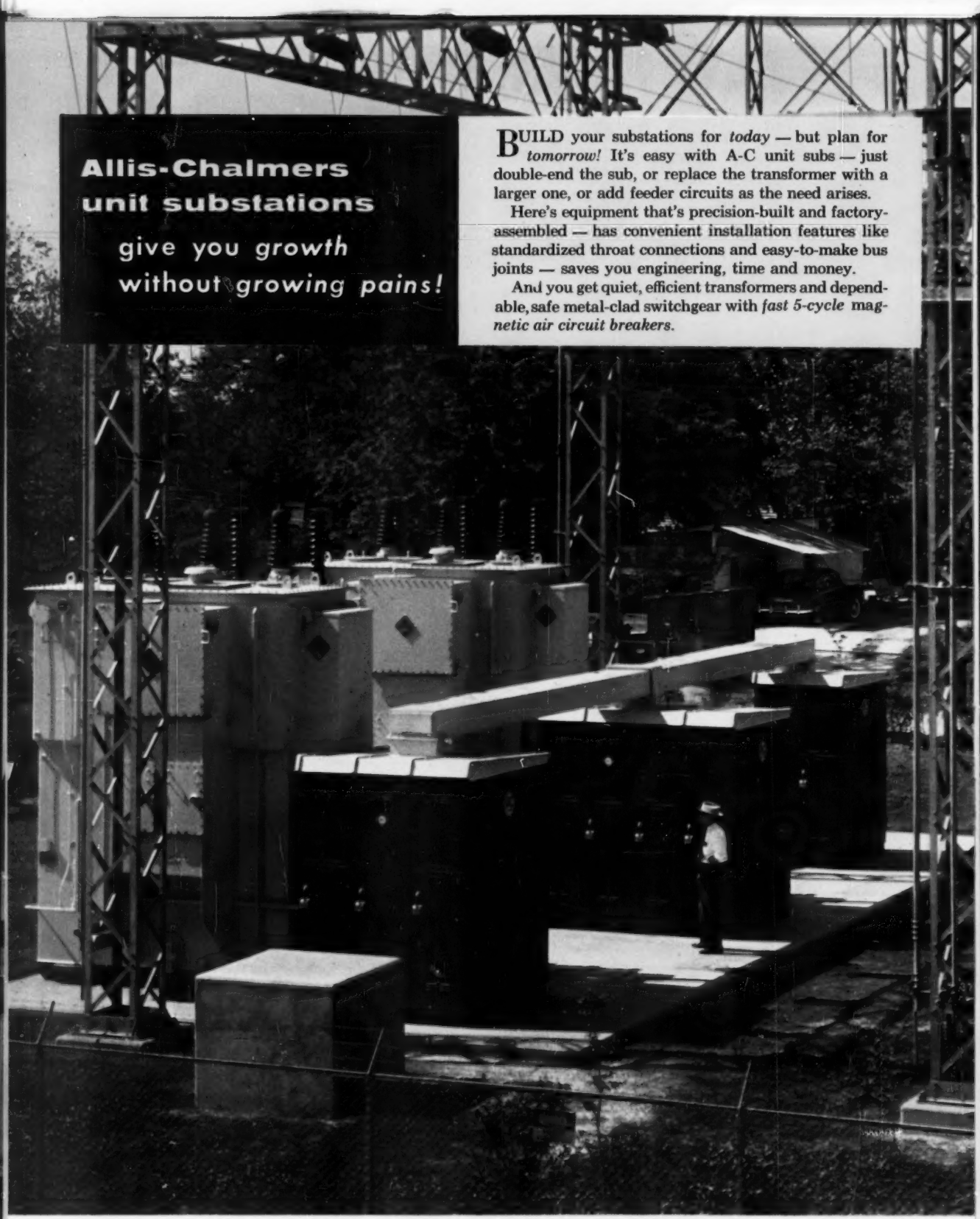
Pneu-Draulic is an Allis-Chalmers trademark.

Get details on this and other features of Allis-Chalmers breakers. Call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

A-5238



Allis-Chalmers unit substations

give you *growth* without *growing pains!*

BUILD your substations for *today* — but plan for *tomorrow!* It's easy with A-C unit subs — just double-end the sub, or replace the transformer with a larger one, or add feeder circuits as the need arises.

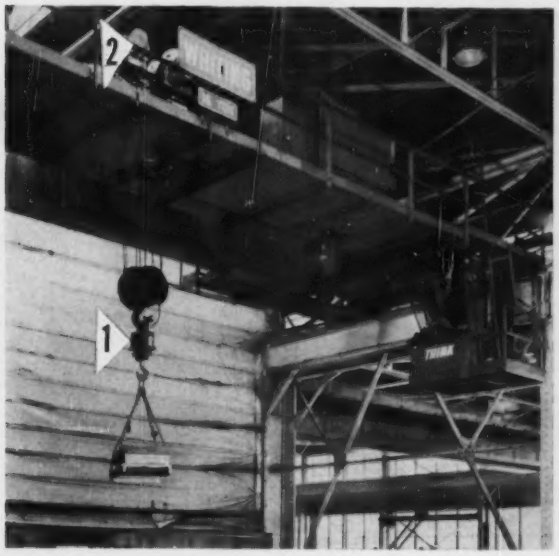
Here's equipment that's precision-built and factory-assembled — has convenient installation features like standardized throat connections and easy-to-make bus joints — saves you engineering, time and money.

And you get quiet, efficient transformers and dependable, safe metal-clad switchgear with *fast 5-cycle magnetic air circuit breakers.*

A-5245

For details regarding A-C unit substations, contact your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS *for progress in switchgear*



With load cell connected to hook . . .

. . . and direct reading scale in cab . . .

Electric Crane Scale Speeds Weighing

L. J. LANGEVIN, Industrial Engineer
Electric Sales Dept, Cincinnati Gas & Electric Co, Cincinnati, Ohio

An electronic scale, installed on a large crane, has greatly simplified weighing and inventorying of various types of steel stock in the Cincinnati plant of Joseph T. Ryerson & Son, Inc, distributors of carbon, alloy and stainless steels. Material handling is greatly reduced, saving both time and money every time a load of steel is weighed. The accuracy of the electronic scale is comparable to that of a good platform scale. Calibrated in 10-lb units, it handles loads as big as 10,000 lbs.

The detecting element consists of a load cell, (1) with the strain elements connected directly to the crane hook. A control cable runs from the load cell to the electronic measuring equipment in the crane cab. An ingenious arrangement of pulleys and a cable reel (2) feed out and retract the cable as required. The cab equipment converts the load cell signals to currents which give a direct reading in lbs on an indicating cyclometer scale. Power consumption is about 200 watts.

Normally, when a platform scale is used, the steel must be picked up, carried to the scale, unhooked, weighed, hooked again, carried back to the original location, and unhooked. With the new scale, the steel can be picked up, weighed, lowered and unhooked. In a 750-ft by 220-ft plant it produces significant savings in time and labor.

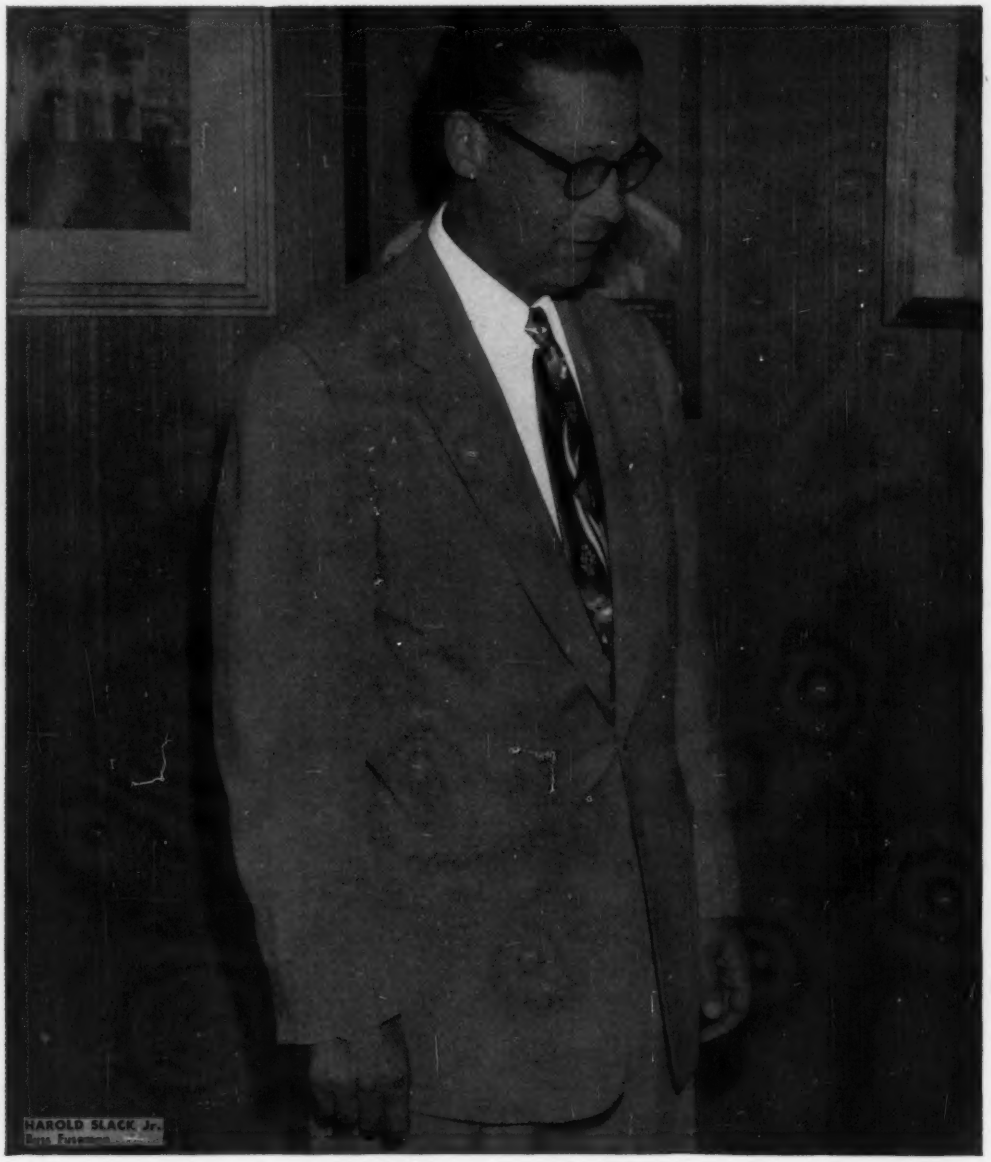
All-electric Lumber Mill Finds Profit in Wastes

TREATED BARK for home gardeners, raw bark for orchid growers, are bagged in program to utilize waste products

New uses for lumber waste are an extra bonus for all-electric operation at Ivory Pine Co's Dinuba, Cal., lumber mill. Ground bark, chips, sawdust, and slabs, all once burned as waste, now add to the revenues.

The four-ft long slabs or edgings are used as gates for shipping fruit in freight cars. Chips are sold to make fiber board; wood flour goes to the plastics industry. A soil conditioner of chemically treated ground bark is marketed for potting plants, and mulching.

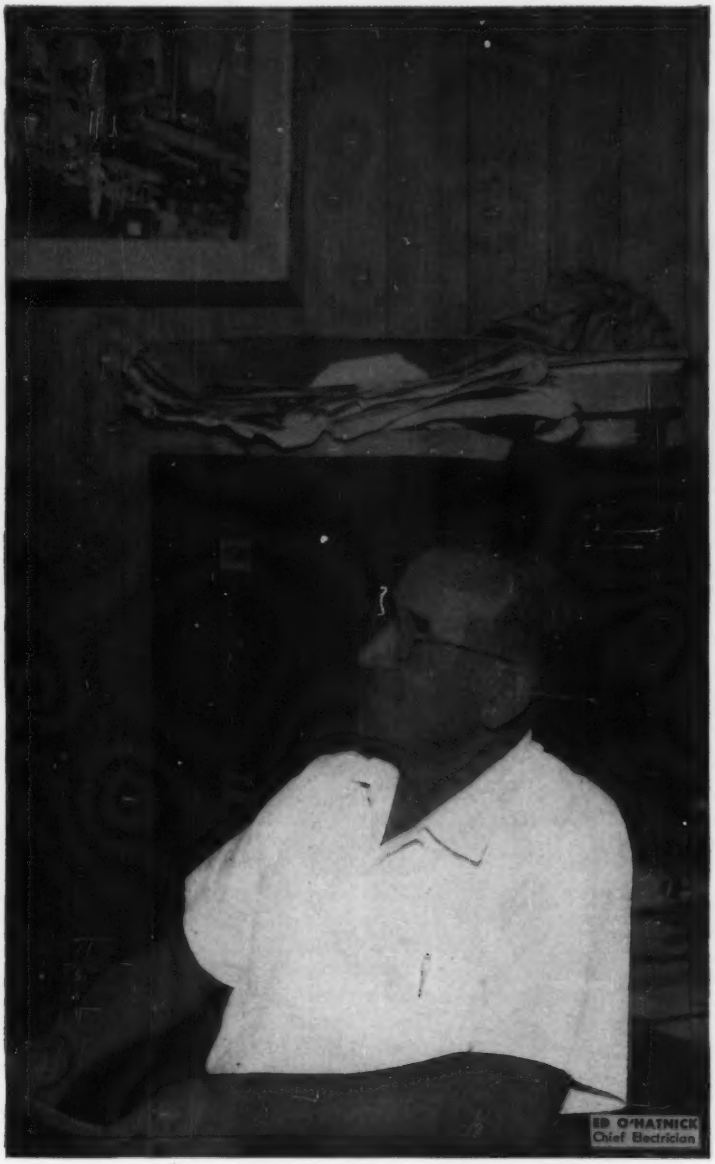
Based on earlier experience with steam, president Edward P. Ivory chose electricity for its economy when building the mill eight years ago. With plans for a sawdust drier and new uses for wastes, Ivory expects to shut down his waste burner completely, one day.



"By installing Fusetron Fuses . . .

We saved from $165 to $225 worth of solenoid coils a year and reduced down-periods"

ED. O'HATNICK, CHIEF ELECTRICIAN
FRANK KNEELAND PLANT, UNITED ENGINEERING & FOUNDRY CO.
PITTSBURGH, PA.



Mr. O'Hatnick continues . . . "The solenoids on the hydraulic clutches of our horizontal boring mills would sometimes stick or slow down when dirt got into the oil.

"When this happened, the tap D. C. solenoid coils wouldn't be pulled in far enough so they would burn up.

"Each coil cost about $15 and with 12 to 18 of them burning up every year it didn't take long for this to add to a considerable amount of money.

"And even more costly were the production losses that resulted from these shutdowns.

"With hope of reducing these expenses, we decided to individually protect the 72 solenoids in use with 3/10 ampere Fusetron dual-element fuses.

"In the next 3 years only 2 coils burned up.

"We had other favorable experiences with Fusetron fuses that convinced me they can make a plant more effective.

"That's why, upon being transferred to our Frank Kneeland Plant, I made a study to see where Fusetron fuses can be applied to help us reduce operating costs."

Here's why Fusetron dual-element Fuses protect solenoids, coils and transformers against burnout.

By installing the proper size Fusetron dual-element fuse, a solenoid can be protected. The Fusetron fuse will not open on the operating surge but will open in time to protect, should the heavy current continue too long for any reason.

A transformer or coil, likewise, can be protected because the long time-lag of the Fusetron fuse permits it to hold all normal current surges and harmless overloads—yet it will open to prevent burnout on any dangerous overload.

All you need to protect Coils, Transformers or Solenoids against burnout is a Fusetron fuse plus a fuse block or a BUSS fuse holder.

On voltages up to 125 the same dependable protection can be provided with a proper size Fusetron plug fuse or BUSS Fustat.

FUSETRON FUSES DO MORE THAN PROTECT SOLENOIDS AGAINST BURNOUT . . . *They Provide 10 Point Protection* **1.** High interrupting capacity—protect against heaviest short circuits. Have proven on tests to open safely on circuits set to deliver in excess of 100,000 amperes. **2.** Protect against needless blows caused by excessive heating — lesser resistance results in cooler operation. **3.** Protect against needless blows caused by harmless overloads. **4.** Provide thermal protection—for panels and switches against damage from heating due to poor contact. **5.** Protect against waste of space and money—permit use of proper size switches and panels. **6.** Protect motors against burnout from overloads. **7.** Give DOUBLE burnout protection to large motors — without extra cost. **8.** Protect motors against burnout due to single phasing. **9.** Make protection of small motors simple and inexpensive. **10.** Protect coils, transformers and solenoids against burnout.

Write for bulletin FIS.

FOR LOADS ABOVE 600 AND UP TO 5,000 AMPS . . . USE BUSS HI-CAP FUSES! When coordinated with Fusetron fuses they will not open ahead of the fuse nearest fault.

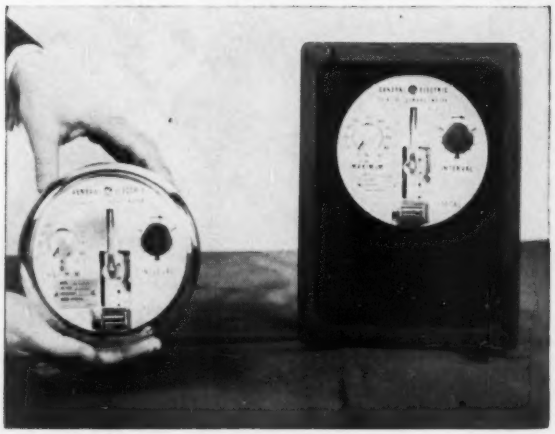
Write for bulletin HCS.

Play Safe! *install FUSETRON dual-element Fuses and BUSS Hi-Cap Fuses throughout entire Electrical System!*

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

BUSSMANN MFG. CO. *Div. of McGraw-Edison Co.*
University at Jefferson, St. Louis 7, Mo.

NEW EQUIPMENT



Printing Demand Meters

The PD-55 printing demand meter has a reported capacity of 1,000 impulses per demand interval, up to a maximum of 1.5 impulses per second. A built-in impulse saver is said to store incoming impulses until the operation is complete, then register them.

Available for 120 and 240 v, at 50 or 60 cps, the PD-55 is ⅓ the size and ¼ the weight of its predecessor with 3.5 times the impulse capacity. Manufacturer claims there is no accumulative error with respect to line frequency and that printing and resetting start within 0.5% of interval rating. It is available in 3 standard models: socket-mounted, shown at left; switchboard, at right; and bottom-connected.

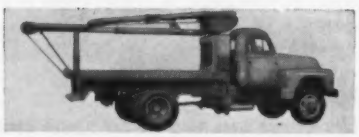
General Electric Co, Schenectady 5, N. Y.

Outage Locator

Designed for use on rural circuits, the outage locator automatically transmits a code or voice modulated radio signal in response to the tripping of an associated recloser. Said to prevent back tracking and cut location time on service restoration trips, the unit locates the fault without subscriber participations and identifies the tripped recloser to the system office.

Range is reported as 35 miles, without directional antenna; power to antenna is 15 watts. The unit is 17 in. high, 6-in. diameter, and weighs 9 lbs. It operates on a 60-cps, 105 to 125-v line and draws 40 w. Accessories include a tape playback, battery power supply, directional antenna, and automatic code typewriter.

Motrel Inc, Hangar 1, Ryan Airport, Baton Rouge, La.

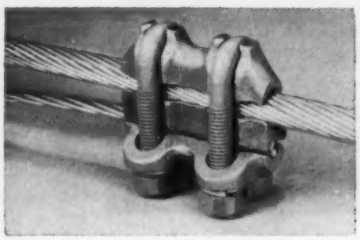


Truck-Mounted Crane

With a rated capacity of 5,000 lb, this truck-mounted crane is available with either horizontal or elevating type booms. Boom swing is 280 deg. Maximum elevation is 85 deg. Power for the Truck-crane is completely hydraulic, with a power take-off driven pump.

The Truck-crane unit requires only 18 in. of space behind the cab, leaves remainder of the body free for payload. Control levers on each side of the truck permit ground-level operation. One lever provides forward, reverse, locking, and speed control for each power movement.

Anthony Co, 1750 Baker St, Streater, Ill.



Heavy Duty Clamps

Parallel groove, heavy duty clamps for making small taps from large runs are available in three models: UP291A26A takes taps as small as No. 2 from 266.8 Mcm runs; the UP33R26A, as small as No. 2 from 400 Mcm runs; and the UP33R291A, 2/0 from 400 Mcm. Conductors may be aluminum, copper, or ACSR.

Made of cast aluminum alloy, the clamps are designed to distribute contact pressure over a large area to hold cable securely, minimize aluminum conductor cold flow.

Burndy Corp, Norwalk, Conn.

Insulation

Made of flexible straight-weave continuous filament glass fabric coated with an organic modified-silicone resin, the T-9278 insulating material is reported to have extremely good solvent resistance and to approach the heat resistance requirements of Class "H" silicone materials.

Measured by the short-time, 0.25-in. diameter electrode method, the dielectric strength is said to be 1,250 v per mil at 1,000 hr., 200 C. The material weighs 0.5 lb per sq. yd., is 0.007-in. thick, and has a tensile strength of 164 lb per in. wide. It is said to have a 10-yr. life at 177 C, based on extrapolated data, and to have good solvent resistance after 48 hr. in both toluene and alcohol. Manufacture states that it shows no disintegration after 48-hr immersion in 100 C oil.

Westinghouse Electric Corp, Box 2278, Pittsburgh 30, Pa.

Solenoid Oiler

The electro-oiler reportedly eliminates variation in drop feeding and is said to permit control of oiling for as many as 24 widely separated bearings from one central point. The oil reservoir feed operates on the liquid seal principle to maintain a constant level at the sight feed valve. The solenoid can be operated by a switch or timer or can be

(Continued on page 141)

YORK-HOOVER announces

the new RANGER unit

for heavy duty line work

The Ranger derrick incorporates an expanding center leg designed for efficiency and safety under heavy loads. Its companion YB pressure digger will operate readily under conditions until now thought impossible.

Get the complete "Ranger" story today! Write for Bulletin No. 944.

"Work Rated" hydraulic derrick

Hydraulic pressure digger for normal and tough "spot" digging.

Combination hydraulic and mechanical winch drive.

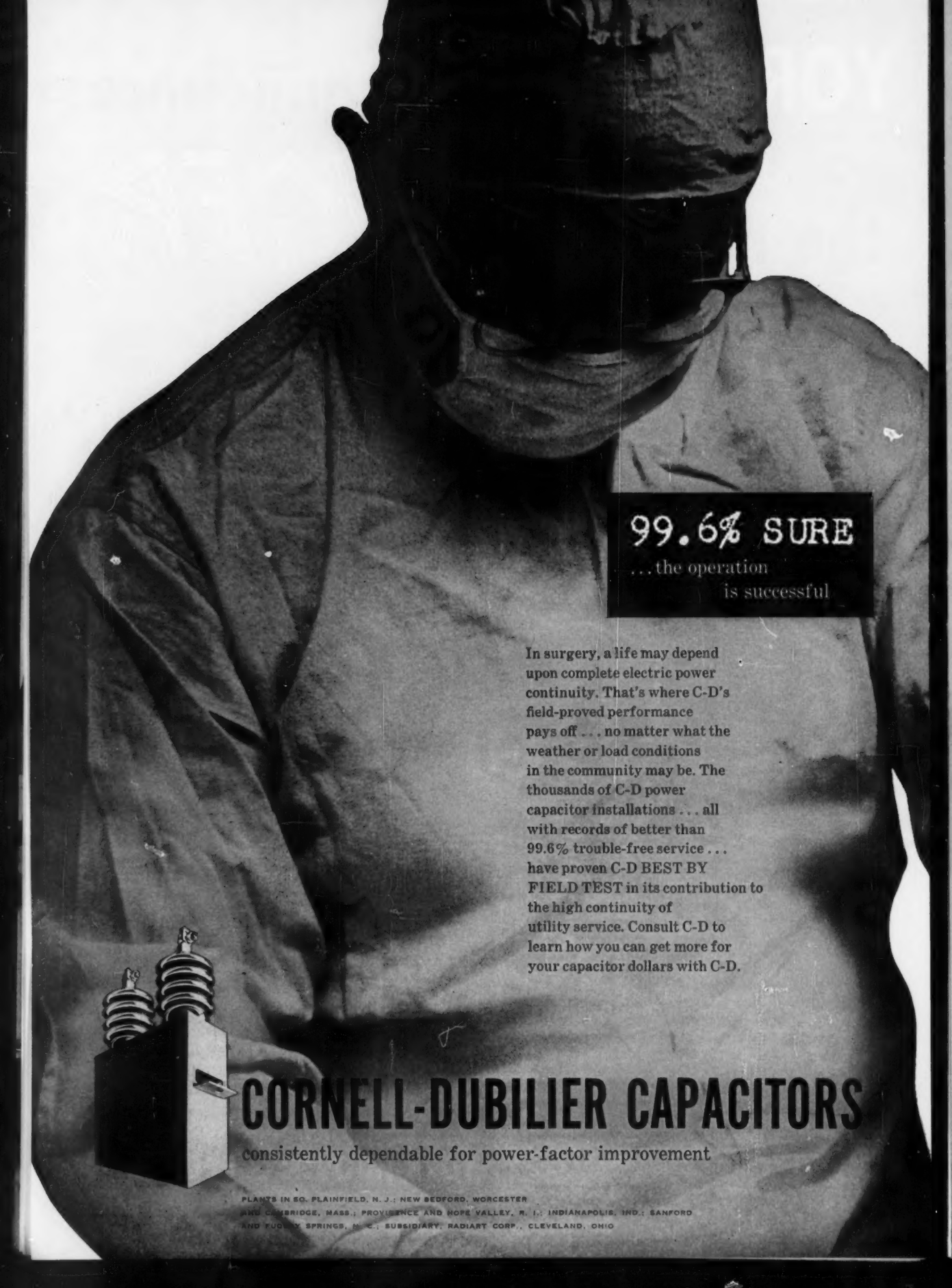
Hydraulic self storing jacks.

Built-in generator for electric power tools.

Rugged body construction designed for tough usage, safety and comfort.

BODY DIVISION
YORK-HOOVER CORPORATION
YORK, PENNSYLVANIA

CREATIVE ENGINEERING FOR THE PUBLIC UTILITY INDUSTRY SINCE 1892


99.6% SURE
...the operation
is successful
In surgery, a life may depend upon complete electric power continuity. That's where C-D's field-proved performance pays off . . . no matter what the weather or load conditions in the community may be. The thousands of C-D power capacitor installations . . . all with records of better than 99.6% trouble-free service . . . have proven C-D BEST BY FIELD TEST in its contribution to the high continuity of utility service. Consult C-D to learn how you can get more for your capacitor dollars with C-D.
CORNELL-DUBILIER CAPACITORS
consistently dependable for power-factor improvement
PLANTS IN SO. PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS.; PROVIDENCE AND HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD AND FUQUAY SPRINGS, N. C.; SUBSIDIARY, RADIART CORP., CLEVELAND, OHIO

CORNELL-DUBILIER power-factor capacitors give you better than 99.6% trouble-free service*

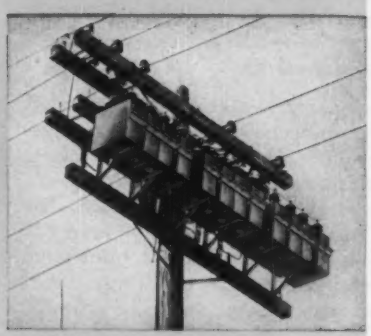
Low dielectric unit stress provides an extra margin of safety that results in the ability to withstand higher transient voltages. When you buy C-D, you buy premium quality at no extra cost.

C-D capacitors are impregnated and filled, in hermetically sealed containers with non-inflammable, non-explosive Dykanol. In addition, C-D's conservative engineering and design makes possible the use of special impregnants to fulfill even the most exacting requirements for sub-zero switching operations.

Extra strength wet process two piece porcelain terminals . . . one of the many important reasons why C-D capacitors can point to year after year of trouble-free service in coastal areas.

Another evidence of C-D's premium quality power capacitor service . . . at no extra cost . . . is the fact that C-D has *no* "Return Material Department". Most repairs are of such a minor nature that they are handled on an individual basis. This results in a prompt, personalized service impossible where the safety factor has been cut in favor of production, weight and size economies.

Why is it that only C-D power capacitors give you assurance of complete dependability?... because C-D's built-in safety factor results from the ultimate in tried and proven design levels coupled with conservative production techniques and rigorous quality control. For catalog write to Cornell-Dubilier Electric Corporation, South Plainfield, N. J.



This pole-mounted C-D Capacitor installation has been on the job for an Eastern utility since 1939 with little or no maintenance.

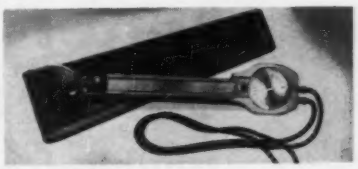
***This is an average based on reports from leading utilities using C-D capacitors. Many of these reports have shown 100% trouble-free service, and none lower than 98.9%.**

Solenoid Oiler

(Continued from page 138)

wired across the line of the driving motor to provide automatic operation.

Oil-Rite Corp, 2375 Waldo Blvd, Manitwoc, Wis.



Range Finder

The Range Finder is intended for quick and easy measurement of distances between 8 ft and 10 ft, especially when object or place is inaccessible. The unit has a 6-in. base and is easily carried in the pocket. It is said to save time and money in wire erection and maintenance.

Operation is based on the coincidence of two images, one in natural color, the second in strongly contrasted gold color. When images coincide, operator reads distance on a dial. Accuracy is reported to be within 2%.

Edmund Scientific Co, Barrington 25, N. J.

Control Indicator

The Series 1450 instruments are designed as pressure and temperature indicators, transmitters, and controllers. Housed in cases of plastic impregnated fiber glass, they are said to be suitable for use outdoors or in corrosive atmospheres. Temperature range is from —400F to +1000F; pressure range from 30 in. Hg vacuum to 5,000 psi. As pneumatic receivers, they can accommodate 3 to 27 psi signals.

They may be equipped with single or dual indicators, single indicator with dual alarm, indicating transmitter, or indicating controller with any mode of control. Transmitter can provide pneumatic, resistance, or differential transformer outputs. The four optional controllers offered are: 1) wide band proportional; 2) wide band propor-

(Continued on page 142)

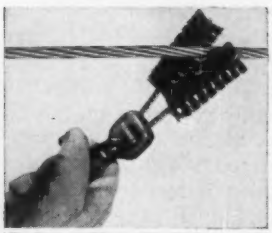
KEARNEY AIRSEAL

and these 4 simple steps

give you

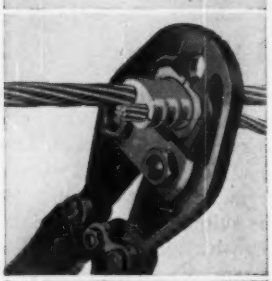
Better Electrical Connections...

trouble-free service for years to come!



CLEAN conductor contact surfaces with Kearney Cleaning Brush to completely remove oxides and foreign matter from between strands. Cleans two sides of conductor at once, in half the time. There are Kearney Brushes for hand and hot-stick use.

PROTECT cleaned contact surfaces with Kearnalex Corrosion Inhibitor. Non-hardening, non-flowing, greaseless paste . . . seals out oxidizing agents and moisture. Will not harm hands or rubber gloves; washes out of clothing. In cans or tubes.



SELECT the right Kearney Squeezon Connector for the size and type of conductors, and the kind of connection being made. Then select installation tool best suited to apply connector, and the proper die. There is a Squeezon Connector for every distribution line connection, and easy-to-use Kearney tools for cold or hot-line work.

SEAL—and permanently protect high initial conductivity of finished connection—with Kearney Airseal. Pliable, non-hardening, easily molded; doesn't stick to gloves or hands. *Seals out* air and moisture—especially good for blocking galvanic action in bi-metallic connections, or those operating in corrosive atmosphere. In pads or rolls.

372

JAMES R. KEARNEY CORPORATION, *General Offices:* **4224-42 Clayton Ave., St. Louis 10, Mo.**

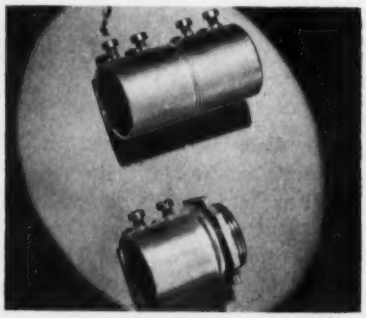
for BETTER CONSTRUCTION
SAFER MAINTENANCE
Specify **KEARNEY PRODUCTS**

Plants at: ST. LOUIS • FAYETTEVILLE, ARK. • SHENANDOAH & CLARINDA, IA.—GUELPH, ONT., CAN.

Control-Indicator

(Continued from page 141)

tional plus automatic reset; 3) wide band proportional plus automatic reset plus derivative; 4) universal controller with on-off, proportional, differential gap, and reset.
Fisher & Porter Co, 951 Jacksonville Rd, Hatboro, Pa.



Screw Couplings

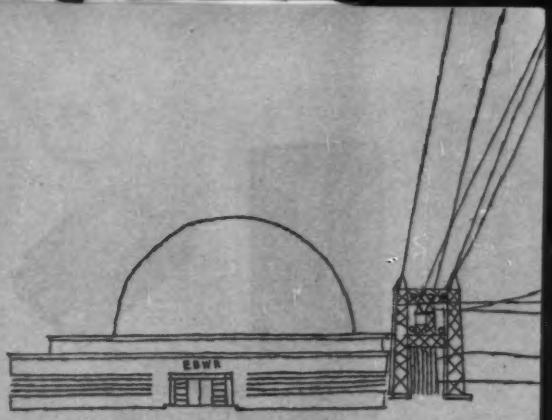
Tube-Weld 1¼-in. set screw couplings and connectors supplement three available sizes. Fittings are one-piece, heavily plated, solid steel tube, with large inside working diameters. Pre-set and staked screws are said to prevent loss of hardware.
Electric Tube Products, Inc, Maspeth, Queens, N. Y.

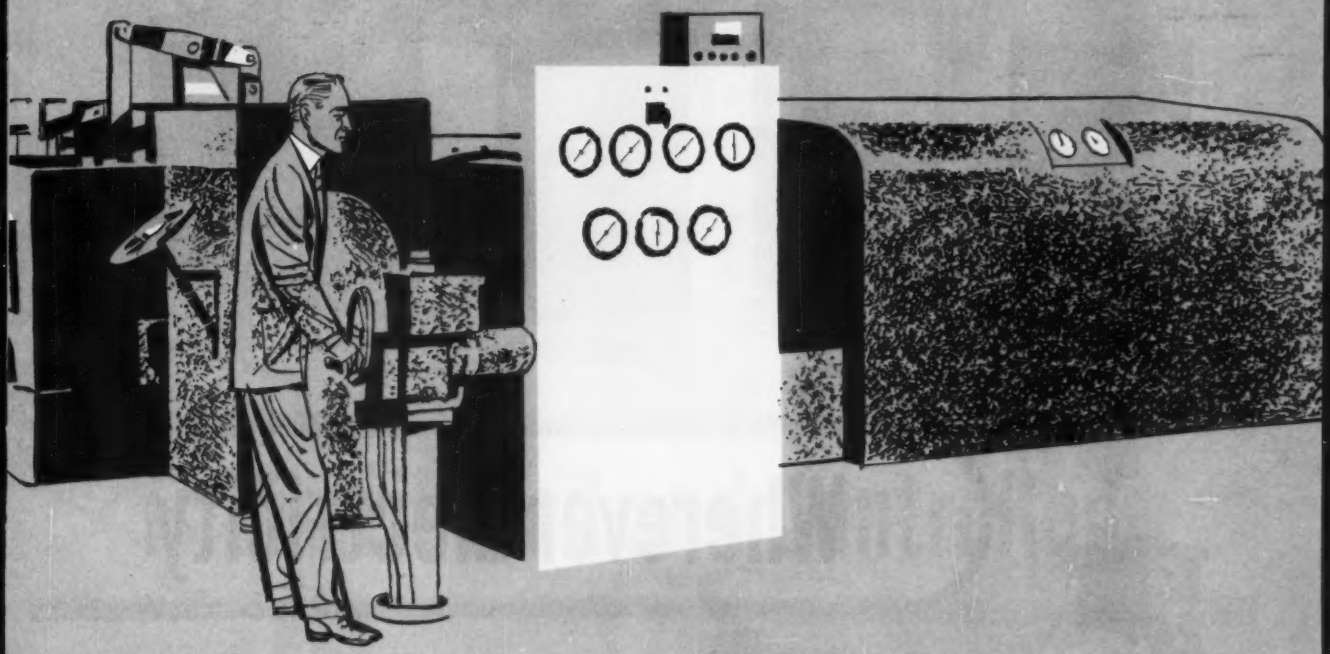
Data Transmission System

Electro-Span is a digital data transmission and control system which can be used for complete remote control of power distributing stations. A unique meter scanning device digitizes voltage, current, and power data at remote points and transmits it to a central control point in code form. System may be applied to telegraph circuits, telephone lines, VHF radio, or microwave links and is said to be unaffected by frequency drift, phase shift, or transmission distortion. Operator at central control can observe circuit loads, select and switch substation circuits. Readout may be on automatic typewriter, chart, lamp, punched card or tape, with logging at substation and control.
Bendix Aviation Corp, North Hollywood, Cal.

(More New Products on page 146)

STANDARD OIL PRODUCT HAS ROLE IN HISTORY-MAKING EVENT





Last December at Argonne National Laboratory, Lemont, Illinois, the Experimental Boiling Water Reactor achieved its design power level of 5,000 kw. for the first time. The lubricating oil in the Allis-Chalmers turbine was Standard's NONPAREIL Turbine Oil.

In a boiling water reactor, live steam is generated in the uranium core and piped to the turbine. There is no coal pile on the site and no ash heap. The reactor consumes less than an ounce of uranium in 24 hours. While the unit is regarded as a tool for research, it is now supplying an important part of the electrical energy required by this 2,700 man laboratory.

Near the turbine of this history-making research tool will hang a framed guarantee certificate. This document will certify that the 350 gallon fill of NONPAREIL Turbine Oil is *guaranteed for the life of the turbine*. More than 1,800 of these certificates have been issued; the first one more than 30 years ago. The guarantee still stands.

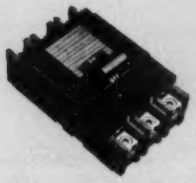
As with every NONPAREIL Turbine Oil installation, an additional technical service is performed. Standard Oil men with engineering training and long experience in lubrication work take samples of the oil for analysis twice yearly to make sure the oil continues to meet guarantee conditions. In the case of Argonne National Laboratory, industrial lubrication specialists from Standard Oil's division office in Joliet, only a few miles away, do this work.

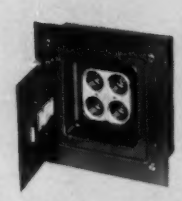
Such service as this is available to you from your nearby Standard Oil office anywhere in the 15 Midwest and Rocky Mountain states. Call there. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

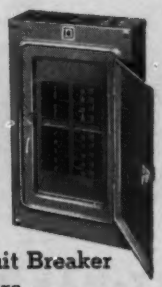
STANDARD

STANDARD OIL COMPANY
(Indiana)

• Safety Switches and
Industrial Circuit Breakers

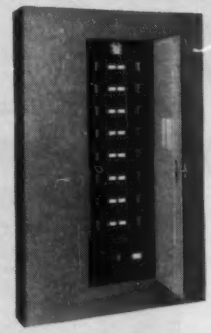






• Fusible and Circuit Breaker
Load Centers

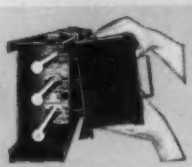
• Voltage Testers

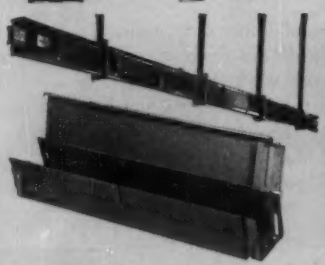


• Fusible and Circuit Breaker
Lighting and Power Panelboards

• Power Distribution Switchboards
and Switchgear

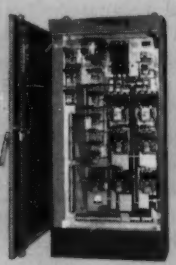
Wherever Electricity





• Busways and Wireways

EC&M
High Voltage and
Synchronous Starters



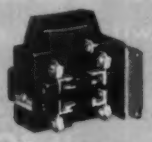
• Special Purpose
Control

• Control Centers

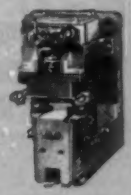
SQUARE D COMPANY

• A.C. Manual and Magnetic Starters

• Drum Switches



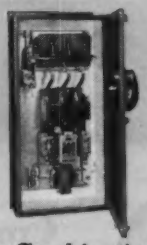
• Control Relays



• Timing Relays

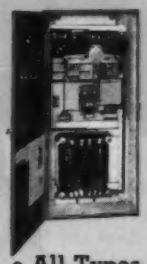
• Limit Switches

• Pushbuttons

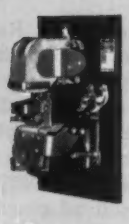


• Combination Starters

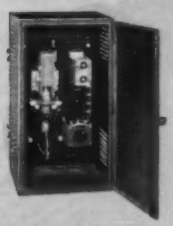
• Manual Compensators



• All Types of Reduced Voltage Starters



• D.C. Starters

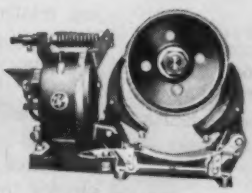


• Electronic and Electro-Magnetic Welder Control

• Float & Pressure Controls for Pumps & Compressors

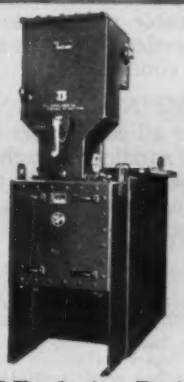
is Distributed and Controlled

EC&M
Lifting Magnets

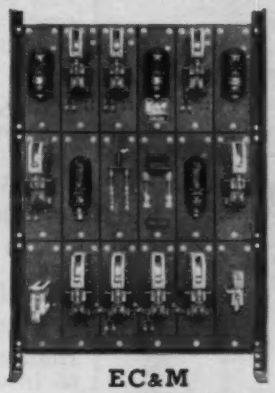


EC&M
Magnetic Brakes

FIELD ENGINEERING SERVICE
available through Square D branch offices
in all principal United States cities
... and in Canada, Mexico and England



EC&M Explosion-Resisting
Control for
Petroleum Industry



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Fast to make fast!

Safe, swift cable connections with

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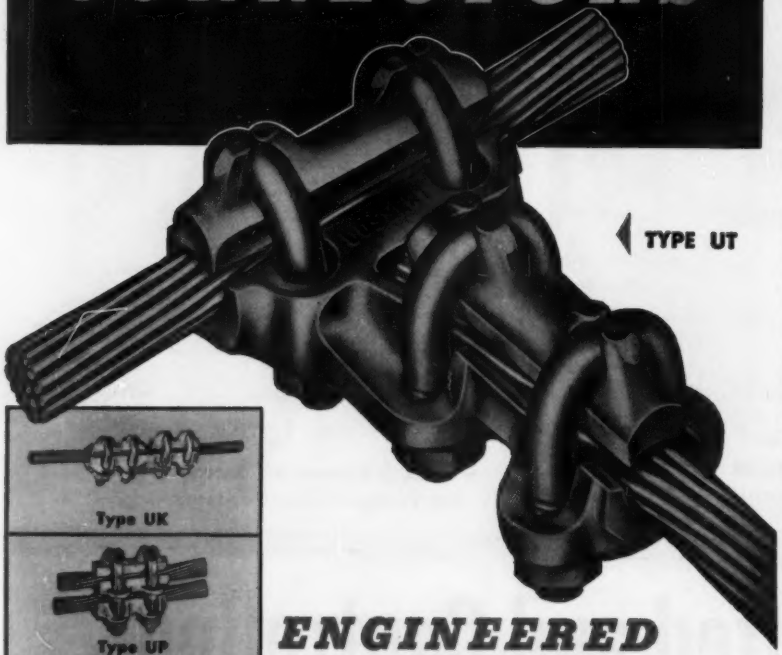

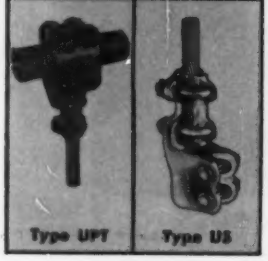

ENGINEERED FEATURES:

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Fits many cable sizes, reduces number of connectors needed for given number of combinations of conductors.

HIGH CLAMPING ACTION
U-Bolts clear all conductors by close limits, supported by saddles through their full arcs. Minimizes bending action, makes U-Bolts subject to tensile stress only.

CABLE END RELIEF
Allows for distortion in free ends of strands, ample room for binding end of stranded cable if desired.

CONDUCTIVITY
High copper alloy with sufficient contact area to insure cooler-than-conductor operation under maximum load.

50 YEARS OF TECHNICAL KNOW-HOW

Available for aluminum or aluminum to copper conductors.

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MORE NEW PRODUCTS

General Electric Co, Schenectady 5, N. Y., offers a design 2/50 completely submersible **sump pump,** reported to be light weight and rugged.

Briscoe Mfg Co, 1055 Gibbard Ave, Columbus 3, Ohio, has Briskeat flexible **heating tapes** with temperature limit of 900 F. Widths offered are from 0.25 to 4 inches in 0.125-in. increments.

Amco Plastic Pipe Co, San Leandro, Cal., **plastic conduit** in eight diameters from 0.5 to 4 in. Available in 20-ft lengths, it is said to weigh ⅛ as much as steel and have good physical and electrical resistance.

Federal Telephone & Radio Corp, 1000 Kingsland Rd., Clifton, N. J., offers a Type FT-VKB **dielectric test bridge** for testing sheet plastics, transformer oil, and other liquids. Dissipation factor range can be extended to unity at power frequencies with a small adapter.

Frank R. Cook Co, Denver, Colo., has available a self-energizing silver-zinc **battery,** rated 700 w, which delivers 20 amp at 28 v or 80 amp peak for short time. Battery weighs 1.75 lb, measures 2x3x5 in.

Ward Leonard Electric Co, Mount Vernon, N. Y., has Bulletin 60 Dancer Roll **rheostats** for holding relative speeds within specified limits on multi-motor drive process machinery.

Homelite, Port Chester, N. Y., markets a 3-kw **gasoline-engine generator** for floodlights, portable electric tools, and emergency standby service.

Balteau Electric Corp, Stamford, Conn., has a Baltospot 200 portable **X-ray machine,** with a capacity of 200,000 v, as an all-purpose field unit for radiographic inspection.

Hupp Electronics Co 743 Circle Ave, Forest Park, Ill. markets an ERX electronic **remote switching system** that allows more than 1,000 different codes to be transmitted over a single 2-way channel.

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ALL-HYDRAULIC LADDER
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Please send me the factual technical bulletin about Holan's 2100 Hydraulic Ladder.

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CATALOGS—BULLETINS

● **INDUSTRIAL BATTERIES:** "So You're Going to Buy an Industrial Battery" is the title of a 16-page booklet designed to help industrial battery buyers select the best batteries for their needs. Published by Gould-National Batteries, Inc, Trenton, N. J.

● **RADIOACTIVITY DETECTION:** Monitoring systems for the detection, recording and warning of airborne radioactivity are described in Bulletin AM-57, available from Nuclear Measurements Corp, 2460 N. Arlington Avenue, Indianapolis 18, Ind.

● **TRUCK BODIES:** Two publications describe the truck bodies made by York-Hoover Corp. Bulletin No. 942 covers the model YMR-76 Service Body; and Bulletin 941 describes the Model SLW-96 Line Construction Body. Write York-Hoover Corp, York, Pa.

● **'FOTOFORM' GLASS:** A brochure, "New Developments in Corning Fotoform Glass", details information on four basic types of Fotoform glass. It also reviews the latest electrical applications of the material. Write for EPFF-1 to Staff Sales Mgr, Electrical Products Division, Corning Glass Works, Corning, N. Y.

● **ELECTRICAL RESISTANCE HEATING MATERIAL:** A 16-page illustrated brochure gives complete data on KANTHAL SUPER, a new ultra high-temperature electrical resistance heating material for continuous use at temperatures to 2,900 F. Write Kenthal Corp, Amelia Place, Stamford, Conn.

● **CABLE:** Power and welding cable manufactured by Paranite Wire & Cable Division of Essex Wire Corp is described in a 4-page brochure issued by the company. Write the company at Fort Wayne 6, Ind.

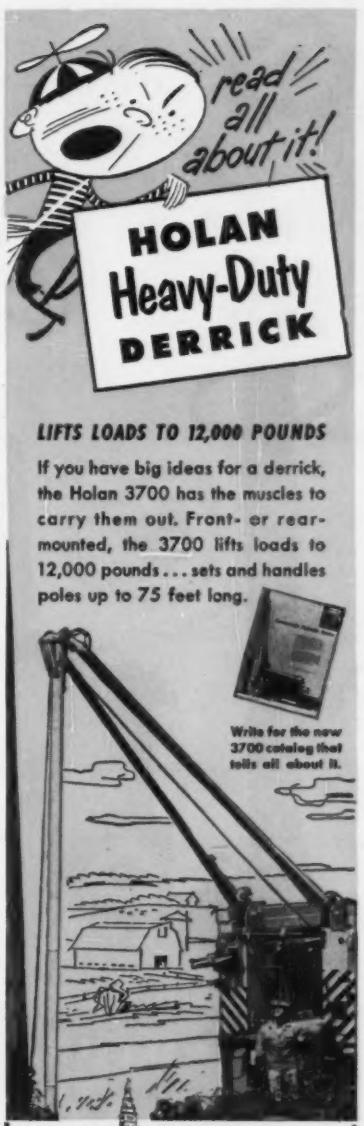
● **RESISTORS:** Catalog Data Bulletin C-1b gives data on construction, characteristics, coating, winding, insulation identification, mechanical strength, terminals and brackets of the tubular and flat power wire wound resistors manufactured by International Resistor Co, 401 N. Broad Street, Philadelphia 8, Pa.

● **PUSHBUTTONS:** Buttons for lighted pushbutton switches are detailed in Data Sheet 117 published by Micro Switch Division, Minneapolis-Honeywell Regulator Co, Freeport, Ill.

● **RECORDING INSTRUMENTS:** Two booklets have been issued by Esterline-Angus Co. on its recording instruments. The first, catalog section 35, covers kva and kvar recorders for analysis of system and plant loads; the second covers recording ac wattmeters and dc/ac-dc (utility) wattmeters of the electrodynamometer type. Write Esterline-Angus Co, Inc, P.O. Box 596, Indianapolis 6, Ind.

● **'TEFLON' EXTRUDED TUBING:** A combined specification sheet and price list for Flexite Teflon extruded tubing has been released by L. Frank Markel & Sons, Norristown, Pa.

● **CONTACT MATERIALS:** a Technical Data Bulletin (No. CM-901) on clad metals, contact materials, and contact assemblies has been issued by American Silver Co, 36-07 Prince Street, Flushing 54, N. Y.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DERRICK
LIFTS LOADS TO 12,000 POUNDS
If you have big ideas for a derrick, the Holan 3700 has the muscles to carry them out. Front- or rear-mounted, the 3700 lifts loads to 12,000 pounds... sets and handles poles up to 75 feet long.
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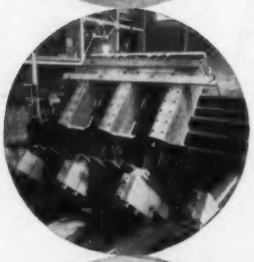
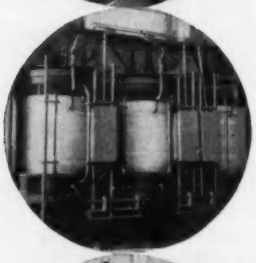
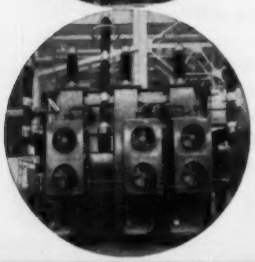
Start of
Coil Winding



Raising Core To
Vertical Position
For Coil Stacking



Assembled Core
and Coil Unit



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Transformer

MEB7-1

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Recently installed in a large southern utility system, this Moloney Power Transformer is now in service.

Rated 135,000 KVA, 3 phase, 60 cycle, F. O. A. Outdoor Type, High voltage 115,000 Y/66,400; Low voltage 13,800 Delta.

Engineered, designed, fabricated, assembled and tested in the Moloney Factory, this transformer is another one of many which will aid utilities in meeting the ever growing power demands of today and tomorrow.

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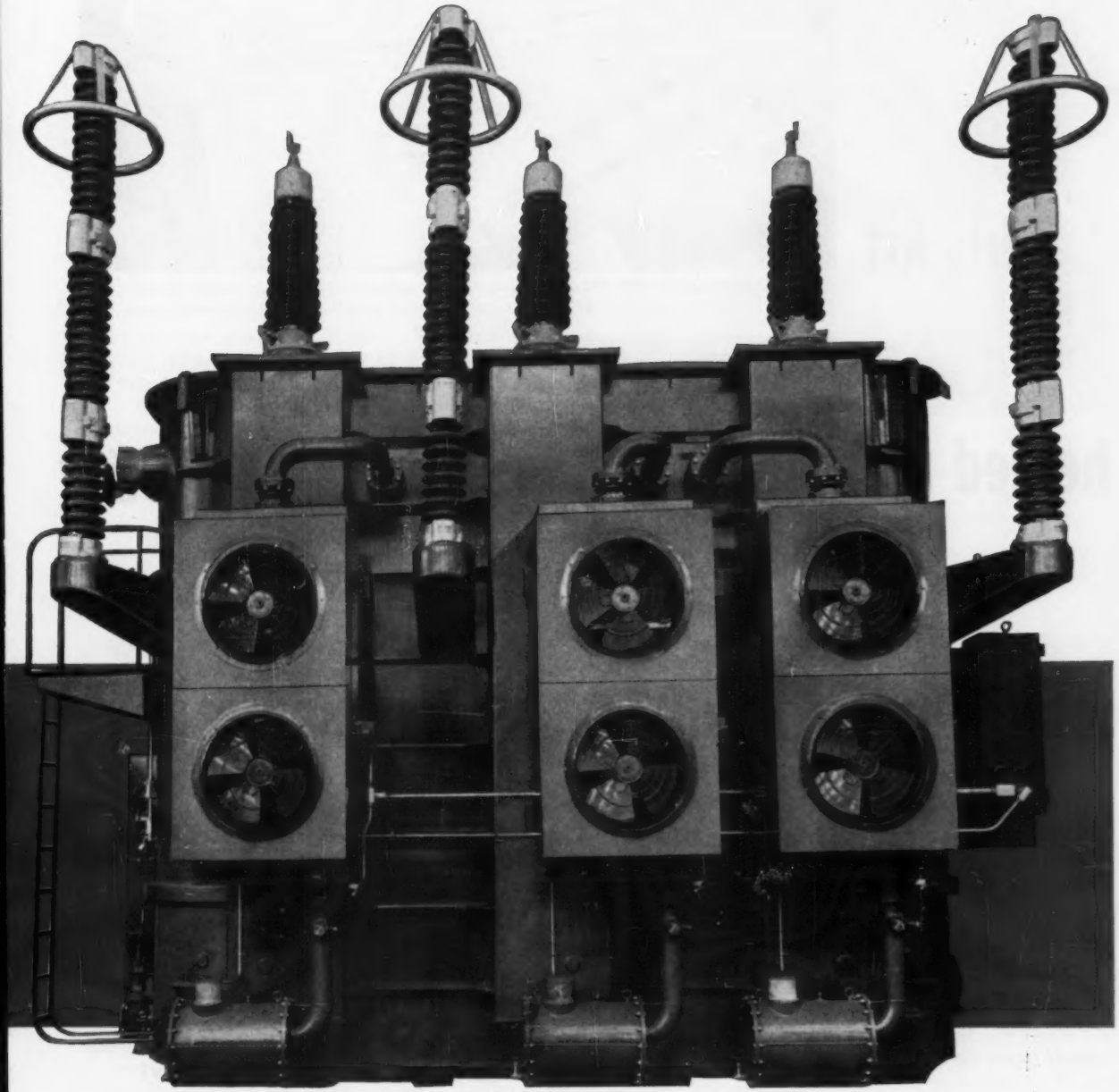

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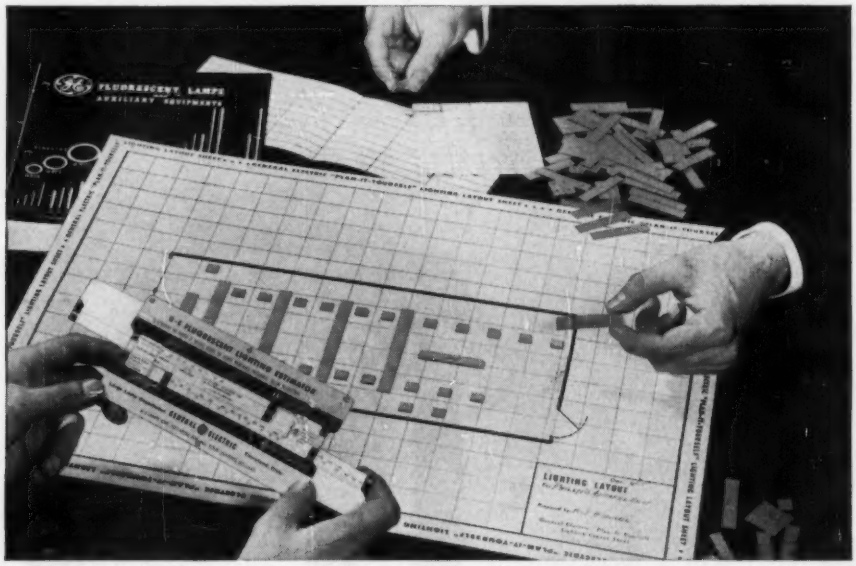

G-E Lighting Layout Kit *contains layout sheets; a fluorescent lighting estimator; movable, scaled "fixtures"; gummed "fixtures" for your permanent layout; and a lighting design guide.*

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Mr. Harry K. Flynn *of Welch Electric Co., Urbana, Ohio.*

sell three lighting jobs worth $1,300 . . . all the same day"

New General Electric "Plan-It-Yourself" Lighting Layout Kit can help you sell More Lighting Jobs, Too!

Mr. Harry K. Flynn of Welch Electric Co., Urbana, Ohio, read about the new G-E *Lighting Layout Kit* . . . sent for it . . . and put it to work. *The next day, he used it to help sell 3 lighting jobs totaling over $1,300 worth of business!* Here's how a G-E *Lighting Layout Kit* can help you make more sales, too:

1 **YOU'LL SELL EASIER** because your prospect is in on the planning and he helps sell himself. He visualizes his lighting requirements more easily.

2 **YOU'LL "SELL UP".** Your prospect sees why the new lighting layout fits his needs, so you can sell him a better lighting job . . . and make more profit!

3 **YOU'LL "CLOSE" MORE SALES.** Your prospect okays the completed layout and your sale is half closed, even before a complete cost estimate is made.

Get your G-E Lighting Layout Kit from your General Electric Lamp Supplier today!

Or send $1.75 to: General Electric Co., Large Lamp Dept. WE-4, Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Rotor Hot Balance Test Pit Put in Service by A-C

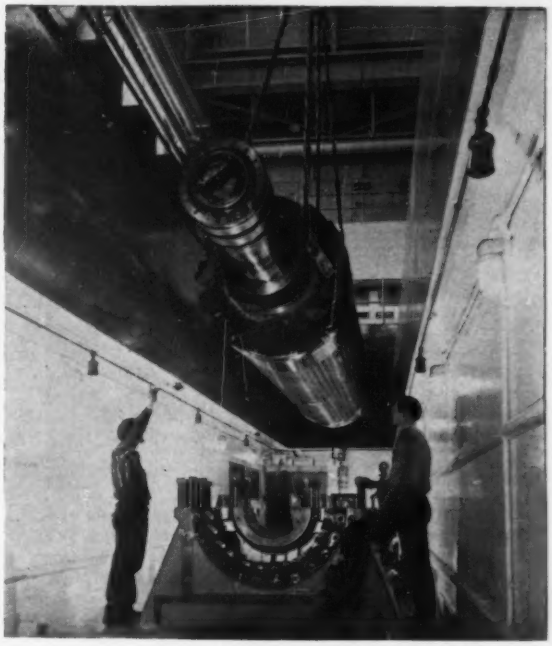
A hot balance test pit, constructed to handle turbine-generator rotors of many sizes, has been placed in service at the West Allis Works of Allis-Chalmers Mfg Co.

The pit is considered to be the most modern of its kind in the country. It is used for precision balancing and overspeeding of turbine-generator rotors under temperature conditions simulating actual operation.

This test facility is 50 ft long, 11 ft wide, and 18 ft deep, and is constructed of massive reinforced concrete and steel. It has a 9-ft thick breech-block cover arrangement with shock-absorbent sections of steel and timber. This high-energy-retention construction also serves as a sound absorber.

A 2500-hp, two-speed motor is used to drive the test rotor through an eddy current coupling and speed increaser. It is capable of rapid acceleration as well as accurate speed adjustment. Temperature of the rotor is regulated by control of air flow through four ventilating fans.

A control room on the main floor is equipped with remote indicating, testing and precision balancing instrumentation. Complete observation and supervision of the facility is conducted from this room. Access to the generator rotor between test runs is afforded by an elevator between the control room and the pit level.



This picture, worm's eye view of Allis-Chalmers new test pit, shows a 98-ton, 1800-rpm rotor for a 300-Mw steam turbine-generator being lowered into bearings at the bottom of the 18-ft deep facility for balancing and overspeeding.

Westinghouse, I-T-E- Low for Dalles Breakers, Bus

Westinghouse Electric Corp, Portland, Ore., with an offer of $210,600 was low for furnishing circuit breakers for The Dalles Dam main generating units No. 9 to 14 when bids were opened by the Portland District Corps of Engineers.

I-T-E Circuit Breaker Co, Philadelphia, bid low with $334,290 for furnishing bus structures for the same units.

The Westinghouse bid was firm and the I-T-E bid subject to adjustment for labor and materials. The equipment must be delivered by August, 1959.

Westinghouse bid $468,711 for furnishing the bus structures.

Other bidders were: Delta-Star Electric division of H. K. Porter Co, Chicago, $467,820 for the bus structures; Allis-Chalmers Mfg Co, Portland, $361,740 for the circuit breakers; and General Electric Co, Portland, $276,679 for the circuit breakers and $465,845 for the bus structures.

Delta-Star, Allis-Chalmers and General Electric bids were all subject to adjustment for labor and materials.

Blaw-Knox to Supply Soot Blowers for CEI

Vulcan soot blowing equipment made by Copes-Vulcan Div, Blaw-Knox Co, Erie, Pa., will be used with a new super-critical-pressure steam generator to be installed in the Avon Station of Cleveland Electric Illuminating Co.

The order includes two Selective-Sequence control panels, T-3-E long retractable soot blowers, RW-3-E wall deslaggers, and air preheater cleaning controls. Blowing medium will be air with emergency steam stand-by.

The twin-furnace, Monotube-design steam generator, to be built by Combustion Engineering, Inc, will have a capacity of 1,715,000 lb per hr at 3,950 psig. Expected heat rate will vary from 8,630 to 8,603 Btu per kwhr depending on the feed-pump drives in service.

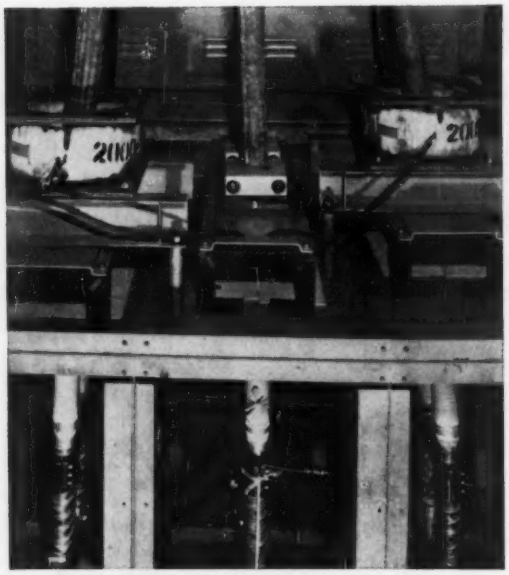
Turbine throttle steam conditions are designed for 3,500 psig and initial temperature of 1,100F with reheat to 1,050F.

$500,000 Research Center Started by Rome Cable

A $500,000 research center will be erected by Rome Cable Corp at its main plant in Rome, N. Y., advises A. D. Ross Fraser, company president.

The new center, a 121-ft square building with a total floor area of 25,600 ft, is expected to be completed by November. Approximately

(Continued on page 154)



GENERATOR LEADS were one of the first applications considered in developing silicone-rubber cables. These G-E silicone-rubber generator leads are in use at the Washington Water Power Company's Cabinet Gorge generating plant.

Breaking the TEMPERATURE BOTTLENECK

The story of General Electric silicone-rubber cable

Several years ago, electrical engineers in generating stations and in industry were faced with what was virtually a bottleneck in the use of high-temperature equipment. They had already obtained greater equipment capacity and reliability through the development and rapid adoption of Class H insulation for generators, transformers, motors, and switchgear. (For example, windings on Class H insulated motors could withstand an operating temperature of 180 C. Switchgear was available for operation at 85 C to 100 C).

But, in many cases, this capacity could not be fully utilized, and the reliability was partially negated, by the cables then available. These cables, which had a maximum permissible copper temperature of 70 to 85 C, could neither carry the load nor withstand the temperatures of the equipment to which they were connected.

A number of electric utilities developed temporary solutions, such as locating copper connections on transformers and switchgear in remote spots away from the heat. On motors, cable connections were stripped of their regular insulation and rewound with hand-applied Class H insulation.

Developing new insulations

To find an answer to the problem of high temperatures G-E engineers continued their search for new insulations. Although asbestos and glass had excellent high-temperature qualities, their low dielectric strength was a drawback — especially in applications above 600 volts.

As part of their continuing search, General Electric engineers tested a form of silicone—silicone rubber. Investigation showed that silicone rubber glass tapes possessed excellent qualities. Furthermore, these tapes could be applied to cable by the same economical methods as conventional tapes of varnished cambric.

The result? A new cable insulated with silicone-rubber-coated glass cloth was developed. Because of its outstanding mechanical and dielectric advantages one of the first applications was its use as high-temperature generator leads. (See Fig. 1.)

New silicone-rubber cables with extruded insulation were also developed for other applications — for power and control circuits. These cables are rated at 125 C conductor temperature for service up to 15 kv for tape types and 5 kv for extruded types.

Thus, General Electric achieved another first with these cables that are proving especially valuable to plants where thermal bottlenecks prevent full use of equipment or where space is limited.

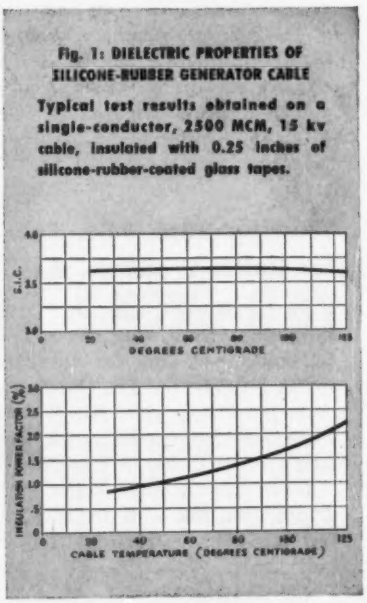
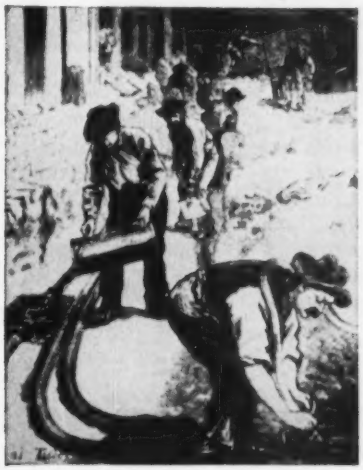


Fig. 1: DIELECTRIC PROPERTIES OF SILICONE-RUBBER GENERATOR CABLE

Typical test results obtained on a single-conductor, 2500 MCM, 15 kv cable, insulated with 0.25 inches of silicone-rubber-coated glass tapes.



IN 75 YEARS, power cable technology has progressed from the Edison Tube of 1881, shown being installed in New York City, to today's G-E silicone-rubber cables.

thermore, silicone-rubber cables increase the reliability of your entire electrical system because the weak link of low-temperature cables has been removed. The recurrent expense of replacing burned-out cable is minimized—an important factor where hot spots (around furnaces, steam pipes, and other sources of high ambients) are problems.

Free booklet offered

General Electric has prepared a new booklet containing complete information on the new silicone-rubber cables. You can obtain your copy by writing for *Silicone-rubber Wire and Cable* to Section W178-427, Wire and Cable Department, General Electric Company, Bridgeport 2, Connecticut.

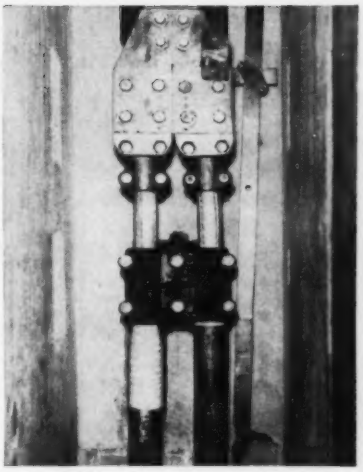


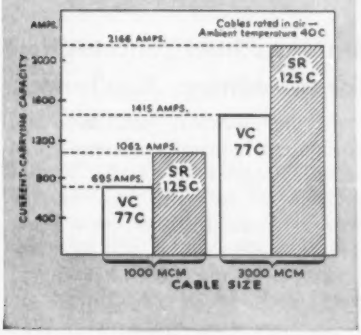
PHOTO SHOWS termination of 2500 MCM, 15 kv silicone-rubber-insulated cable in Con Edison's Hell Gate generating station. Stress cone is completed on cable at left —in process on cable at right.

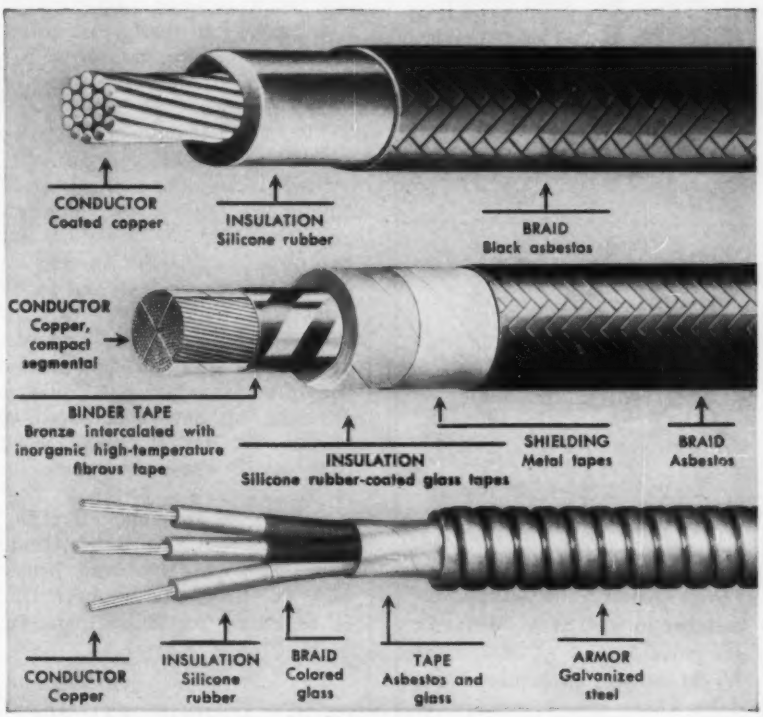
Economic considerations

Silicone-rubber cables offer many economic advantages due to their greater current-carrying capacity (see Fig. 2 below). First, they can be installed in existing ducts and conduits, thereby reducing first costs. Second, the high-current leads require less space on new jobs — and future expansion need not involve extensive renovation. Fur-

Fig. 2: COMPARISON OF CURRENT-CARRYING RATIOS

Varnished cambric vs silicone rubber cable. Based on 9 cables in duct bank, 100% load factor, 25 C earth, open-circuit sheath.





TYPICAL CONSTRUCTION OF SILICONE-RUBBER CABLES. (Top)—Power cable withstands high temperatures in wet and dry locations, exposed or in conduit. (Center)—Generator cable used for high-current generator leads. (Bottom)—Control cable, used for control or signal circuits in wet and dry locations, withstands flame and constant high temperatures.

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$500,000 Research Center

(Continued from page 151)

50 employees will man the three-story glass and brick structure under the direction of Rudolph Schatzel, vice president and director of research.

The research center will feature a complete pilot plant so that experimental production runs can be made without interrupting the normal production activities within the plant. An outdoor area for "weather testing" cables will be included.

Dow Corning Discontinues Sale of Silastic Tape, Cloth

After developing, introducing and raising a product to profitable maturity, Dow Corning Corp, Midland, Mich., is giving it up. "It's too popular," is the reason, according to C. A. Doremire, manager, Electrical Sales.

The product is Silastic Type R and RG tape and cloth, a glass cloth coated with semi-vulcanized silicone rubber. It was originally designed for use as a resilient, high-temperature cure-in-place insulation for motor coils. Other uses include flexible heating elements and curing blankets.

Doremire continued, "In order to concentrate on the development and production of raw silicone products, we have encouraged its manufacture by other competent companies." These companies currently include:

Continental Diamond Fibre Div, Budd Co, Inc, Valparaiso, Ind.; Permacel Tape Corp, New Brunswick, N. J.; Quaker Rubber Div, H. K. Porter Co, Philadelphia, Pa.

Leeds & Northrup to Build Computer for Florida P&L

Leeds & Northrup Co received a contract to build a dispatch computer for the Florida Power & Light Co. The computer will be installed in Miami and will be coordinated with the L&N "Area Control" placed in service in July 1955.

The new computer will be designed to supplement this "Area Control". Operating with the present equipment, the computer is reported to automatically and continuously provide the economic loading for all normal system conditions in complete, closed-loop control on the Florida system. It will automatically include the effect of incremental transmission losses and effectively extend incremental economic load control to 10 generating stations and practically 100% of FP&L generation.

Peak Set in 3-Month Sales by GE, Earnings Up 16%

During the first three months of 1957, General Electric Co set new first-quarter records in both sales and earnings, Ralph J. Cordiner, president, announced. Sales billed, he said, amounted to $1,048,850,000, an increase of 11% over the previous first-quarter record of $946,458,000 set in 1956, and a 26% increase over the first quarter of 1955.

Cordiner reported net earnings for the quarter of $64,006,000, up 16% over comparable 1956 earnings of $54,962,000, and 22% higher than first-quarter 1955 earnings. The earnings were equivalent to 73 cents per share of common stock and 6.1 cents per dollar of sales as compared with 63 cents per share and 5.8 cents per sales dollar for first quarter 1956, and 6.3 cents per sales dollar in the first quarter of 1955.

Stainless Steel Consumption for Machinery, Appliances

In the electrical machinery and equipment industry consumption of stainless steel rose to 19,728 tons in 1956, according to the American Iron and Steel Institute, New York. This consumption is a 120% increase over the 1955 amount of 8,953 tons.

Stainless steel shipments in 1956 to manufacturers of machinery, industrial equipment and tools totaled 56,936 tons, up 38.6% from 41,103 tons in 1955.

Together, these equipment and machinery manufacturers consumed 76,664 tons of stainless steel in

1956, an increase of over 50% from 1955.

Shipments of the steel for appliances, utensils and cutlery totalled 44,413 tons in 1956. This amount is a 7.8% decrease from the 1955 amount.

Total stainless steel shipped in 1956 was almost 687,700 tons, about 1,250 tons more than in 1955. Total SS produced was more than 1.21 million tons or almost 50,000 tons more than in 1955.

U. S. Aluminum Production

Primary aluminum production in the United States in March totalled 135,733 tons, according to the Aluminum Association, New York. This production was an increase of about 16,670 tons over February but a decrease of about 10,160 tons from March, 1956. Total production for the year through March amounted to 401,822 tons, a decrease of about 17,230 tons for the corresponding period in 1956.

M&M BRIEFS

Cerro de Pasco Corp, New York, is studying plans for a 750,000 kw hydroelectric development at Mantaro Bend, Peru, in conjunction with a Peruvian alumina reduction plant. Hydro development capital cost would be approximately $200 million.

Garcy Lighting Div. of Garden City Plating & Mfg Co, Chicago, will be producing commercial lighting fixtures in a 70,000 sq ft plant, recently purchased at 2501 North Ashland Ave, Chicago.

Radio Corp of America, Harrison, N. J., is using the name RCA Electron Tube Division for its Tube Division, to define more precisely the type of products manufactured and merchandised by the Division.

Du Mont Laboratories, Inc, Clifton, N. J., has an automatic "dial-direct" mobile two-way radiotelephone system. Phone calls to-and-from vehicles are reportedly relayed, unattended, through local telephone systems.

Corrosion always costs much more than would the necessary amount of paint to prevent it. Now, more than ever, you can realize tremendous savings in corrosion control with Sipes Tower Finish Gray No. 280, a new one-coat corrosion resistant paint for transmission towers, sub-station structural steel, woven wire fencing and other similar exterior metal surfaces. Tower Finish Gray No. 280 is a full-bodied, rust-resisting coating formulated specifically to render long and durable performance at little more than half the cost of comparable competitive finishes. Exhaustive laboratory tests and actual field tests indicate that it will out-perform competitive products costing ALMOST TWICE AS MUCH.

Eliminate your cost on corrosion — minimize your costs on its prevention. Specify Sipes Tower Finish Gray No. 280 for your next maintenance project. Compare its performance and cost with what you are using today. You'll be convinced . . . paint costs far less than corrosion.

WRITE FOR SIPES TOWER GRAY BULLETIN TG 280

SIPES
Reg. U. S. Pat. Off.

JAMES B. SIPE AND COMPANY
INDUSTRIAL DIVISION
PITTSBURGH 16, PENNSYLVANIA

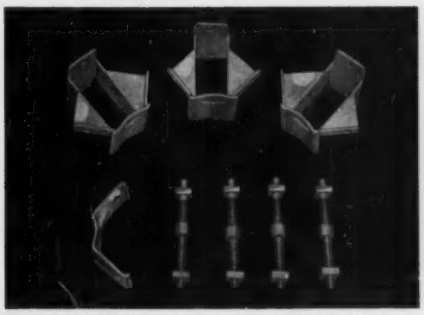
Now one transformer mount

fits all poles 6½ to 16 inches in diameter!

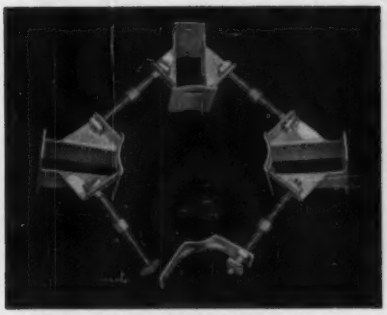
New Hub-Mount* takes all EEI-NEMA Transformers 3 kv to 167 kv in one, two, three combinations

The new Hubbard Hub-Mount brings an entirely new approach to single pole mounting of distribution transformers. It saves you money by eliminating platform construction with its carpentry and maintenance costs. If you are now using single pole mounting equipment, Hub-Mount will cut your inventory because one item fits all the poles normally used in this type of application. Your installation costs will be reduced because the Hub-Mount can be quickly installed by one man, and it is completely salvagable. For the complete Hub-Mount story write for a copy of bulletin P-357.

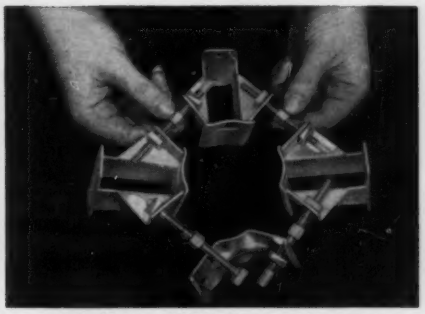
Working scale model demonstrates ease of assembly!



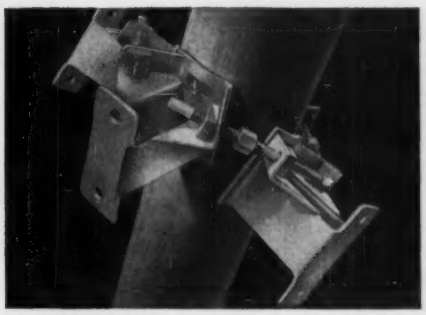
1. HUB-MOUNT assembly is made up of 1, 2 or 3 mounting boxes and quarter plates plus 4 turnbuckle-type bolts. Connecting bolts are fabricated from Cor-Ten steel for long service life. In tests, Hub-Mount has supported more than three times the weight of three 167 kv transformers without any visible deformation!



2. GROUND ASSEMBLY. With so few parts, assembly is simple, trouble-free. Left hand bolt threads and nuts are color-coded to speed assembly by eliminating trial and error. Hub-Mount's all steel design eliminates carpentry, periodic maintenance present in platform construction.

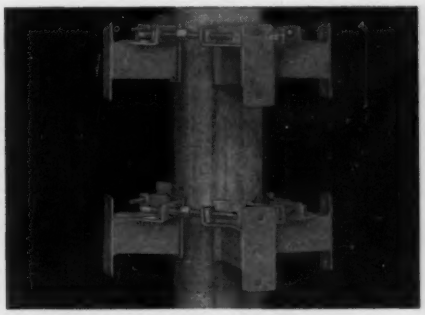


3. GROUND ADJUSTMENT. Turning downward on hex section of turnbuckle bolts adjusts size of Hub-Mount to pole diameter at the point of installation. Hub-Mount has only four points of adjustment. By adjusting three of them on the ground, it is only necessary for the lineman to wrench at one point on the pole.

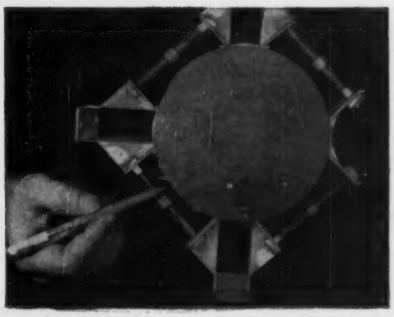


4. MOUNTING. Hub-Mount is lofted to the pole, hung from one lag screw driven into the pole at the desired height. This leaves the lineman entirely free to complete the installation, by connecting open turnbuckle bolt to quarter plate. Lineman makes his installation from one point on the pole!

5. FINAL ADJUSTMENT. Wrenching downward on the hex section completes installation. When installed, Hub-Mounts work in compression, are not loosened by pole shrinkage. The weight of the transformers causes the Hub-Mount to bind on the pole, thereby maintaining a tight grip.



6. READY FOR TRANSFORMERS. This simple, flexible arrangement accommodates all EEI-NEMA transformers from 3 kv to 167 kv in combinations of one, two or three. Hub-Mount's exclusive design places no reliance on welds, which work in compression, do not govern available strength.



7. WRENCH CLEARANCE. Note wrench clearance at maximum adjustment on 16 inch pole diameter.

*Patent Pending

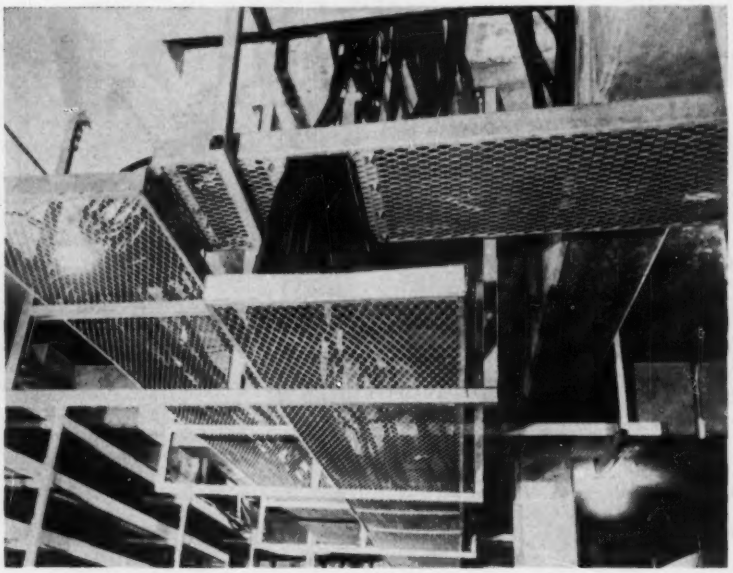
Sold exclusively through Electrical Distributors

HUBBARD AND COMPANY

Pittsburgh 1, Pa.
Chicago, Ill.
Oakland, Calif.
Plano (Dallas), Texas

SUPPORTS FOR CABLE AND TUBING PASS "THE ACID TEST"—

THE APPROVAL OF DESIGNERS, CUSTOMERS, AND USERS WHO SAY: "Well laid out and engineered." "Nicer and sturdier." "Quick and easy to install." "Boy, does that ladder look good!" "We're ordering more." "For my money, I'll take P-W Supports anytime." "Thanks, for good delivery."



P-W offers the latest in support systems—expanded metal, ladder, or solid—which are interchangeable as required. Comes in 3", 6", 9", 12", 18", and 24" widths, in 1' multiples from 1' to 10', 12' and 16' lengths. Can be purchased in two ways: (1) in certain standard lengths, or (2) in various lengths, which, together with P-W's Extension Connectors, eliminate all field cutting. Adjustable Horizontal and Riser Connectors give the greatest flexibility and meet all changes in direction and elevation. P-W's Channel Connectors, with drive rivets, provide not only a quick connection but good electrical continuity.

Our pre-cut system provides the greatest savings in material and installation time—waste is eliminated and the various parts assembled without field cutting. Send us your drawings and we will take off bill of material. When order is placed, we mark up drawings or reproducibles with catalog numbers. Same numbers are placed on items at time of shipment to facilitate field erection. P-W Twist-Rack is available to support trough or ladder.

Join our ever-growing list of outstanding and satisfied customers. The first step is to write today for our catalogs. Let our engineers help you!

P-W INDUSTRIES, INC. Duncan & Melrose Sts., Philadelphia 24, Pa.

Representatives throughout country to serve you!

Georgia Power Installs Steel Poles at River

First tubular steel H-frame structures supported by guys have been installed at a river crossing by Georgia Power Co. The two novel structures, originally designed for a 230-kv line (EW, Jan. 14, 1957, p 56), each carry two 115-kv circuits.

Each structure has two tubular steel poles consisting of a 35-ft and 45-ft section bolted together. Attached to the poles with flexible shackles is a 40-ft long crossarm. The poles are pivoted on concrete foundations, and $12\frac{7}{16}$-in. guys stabilize each structure.

The structures, positioned 775 ft apart, support six 397,500 cir mil 26/7 ACSR conductors and two $\frac{5}{16}$-in., 7-strand steel shield wires. Phase conductors are spaced about 8 ft apart across the arm and are pulled to a maximum tension of 5,550 lb, under light loading conditions. Shielding angle is 38 deg.

Tubular steel structures were installed at the river crossing to provide a permanent structure of sufficient height to meet clearance requirements. Remaining portions of the two 115-kv circuits are carried on single-circuit wood H-frames.

Jersey Utility Gets Land

Public Service Electric & Gas is acquiring a 120-acre site near Trenton (N. J.) for initial construction of a 300,000-kw turbine-generator. Work on the $72.5-million project will start this year for 1960 completion.

To obtain maximum reliability and economy . . .

D. P. & L. Installs Six 1000-hp General Electric Boiler Feed Pump Motors

Six new General Electric Boiler Feed Pump Motors at Delaware Power & Light Company's Delaware City Power Station help provide power and steam for a new petroleum refinery with the largest initial capacity ever built. These G-E motors help generate up to 1,500,000 pounds per hour of superheated steam at 1,300 psig to provide Tidewater Oil Company's huge Delaware Flying 'A' Refinery with both electricity and process-steam required to refine 130,000 barrels of crude oil per day.

New General Electric boiler feed pump motors help provide the reliability and economy needed in Delaware City Power Station's boiler operation. These motors utilize a new bearing system to reduce maintenance. New ventilation system permits close motor mounting, improves employee comfort. Revolutionary Polyex® insulation system lengthens motor life up to 100%. Improved rotor and stator and new acoustic treatment provide reliable, continuous, quiet operation.

Progress Is Our Most Important Product

GENERAL ELECTRIC

ELECTRIC DRIVES FOR THE ELECTRIC INDUSTRY

Where electricity is generated,

electric drives give top performance

. . . here's why

ELECTRIC DRIVES FOR THE ELECTRIC INDUSTRY

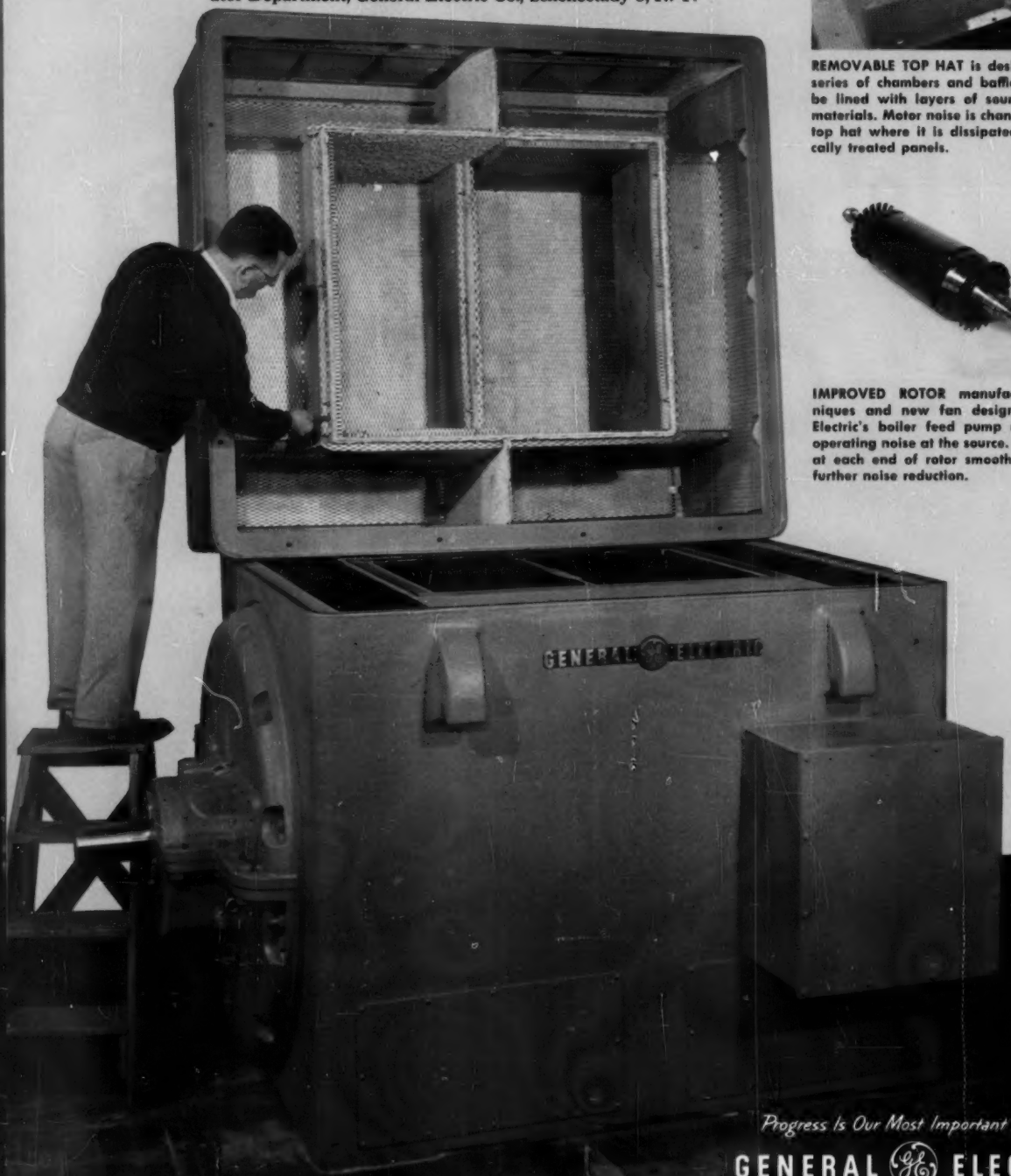
New General Electric Boiler Feed Pump Motors are acoustically treated for quiet operation

For improved employee comfort and efficiency, new General Electric Boiler Feed Pump Motors are sound-engineered for quiet operation. New rotor and fan design cuts aero-dynamic noise. Unique rotor and stator pole slot combinations reduce magnetic noise. A new, acoustically treated top hat muffles operating noise to reduce the high-pitched whine often characteristic of large, high-speed boiler feed pump motors.

FOR MORE INFORMATION on G.E.'s new, quiet-operating boiler feed pump motors, write Section 882-2, Medium A-C Motor and Generator Department, General Electric Co., Schenectady 5, N. Y.

REMOVABLE TOP HAT is designed with a series of chambers and baffles which can be lined with layers of sound absorbing materials. Motor noise is channeled up into top hat where it is dissipated by acoustically treated panels.

IMPROVED ROTOR manufacturing techniques and new fan design of General Electric's boiler feed pump motor reduce operating noise at the source. Air deflectors at each end of rotor smooth air flow for further noise reduction.



Progress Is Our Most Important Product

GENERAL ELECTRIC

ELECTRICAL BUSINESS OUTLOOK

Electrical World
APRIL 29, 1957

Electric companies plan no capital spending cutbacks in the near future despite vexations that tight money conditions may impose. This is one conclusion drawn from a McGraw-Hill Dept of Economics' survey completed last week.

This year's plant and equipment expenditures will be 26% above 1956, electric company interviewees say. Their answers, taken in the midst of last month's economic climate, bolster a preliminary survey made last November, which indicated a 25% increase.

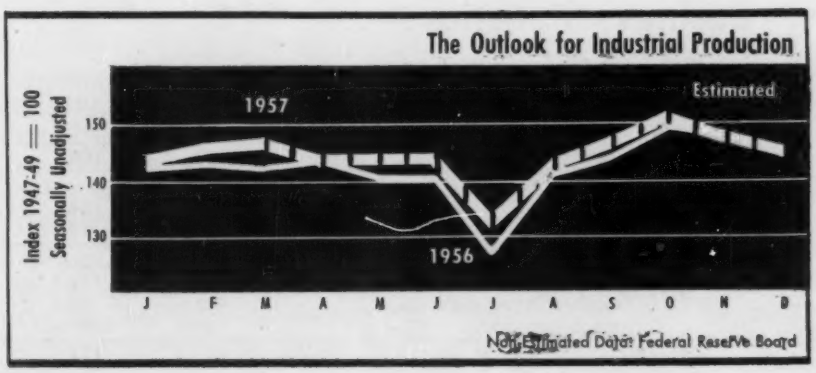
Combined expenditures for gas and electric utilities will hit $5.9 billion in 1957, the McGraw-Hill survey reveals. This would be a 22% gain over last year for the two industries. (Gas expenditures will account for 16% of the increase.) Preliminary plans indicate their combined outlays will reach $5.8 billion in 1958; $5.2 billion in 1959; and $5.1 billion in 1960. These figures for the future are traditionally on the conservative side.

No let up in the capital goods boom is yet in sight, either. Business expects to spend $41 billion on new plant and equipment this year—12% more than last year—and already has plans to spend $34.8 billion in 1960.

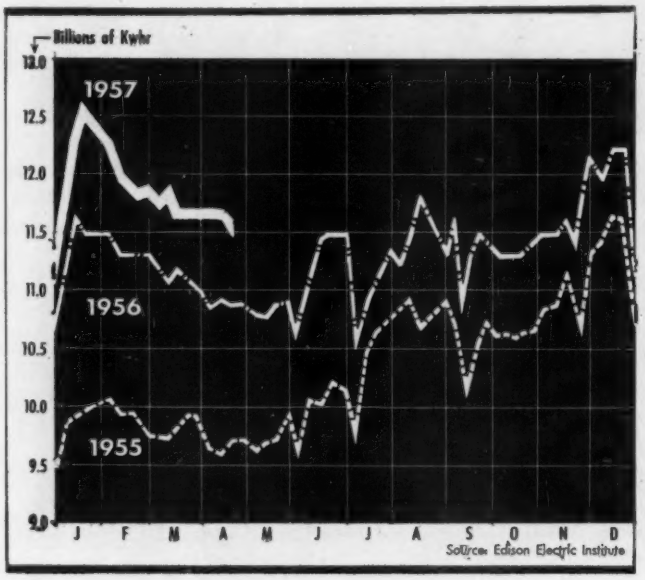
Some big energy consumers are laying particularly ambitious plans. Chemical processors and petroleum refiners now plan to spend more in 1960 than they did during last year's record building spree. And spending is almost always pushed higher as construction dates grow closer. In rubber and electrical machinery industries building plans now in the works for 1960 already top this year's.

Heavy spending on capital equipment is needed to gear industry for production of a rash of new products that will be coming on the market over the next four years, and to expand capacity in line with projected sales increases. Manufacturers now expect that in 1960 as much as 10% of their sales will be in products not now in existence. Spending on research and development, which shot up from $4.8 billion in 1955 to $6.1 billion in '56 and will probably run around $7.3 billion this year, backs up new product expectations.

Industrial capacity will increase about 6% this year if expansion plans go through as expected, and will be up another 9% by 1960. Most extensive plans show up in the electrical machinery, nonferrous metals, chemicals, and metalworking (excluding autos) industries. Manufacturers project a 6% sales increase this year and a 19% increase during the 1957-60 period.



STATISTICS



OUTPUT
Week ended April 20, 11,485,000,000 Kwhr Up 5.4%

Per Cent Change From Previous Year

	Apr. 6	Apr. 13	Apr. 20
Total U. S.	+ 7.8	+7.1	+ 5.4
New Eng.	+ 5.2	+5.2	+ 1.1
Mid. Atlan.	+ 6.1	+4.7	+ 1.6
Cent. Ind.	+ 9.1	+6.7	+ 3.0
West Cent.	+11.8	+9.5	+ 7.1
Southeast	+ 7.5	+7.4	+ 5.4
South Cent.	+ 9.9	+9.5	+11.9
Rocky Mount.	+ 7.1	+7.2	+ 8.8
Pacific			
NW	+ 4.2	+9.5	+10.9
SW	+ 7.7	+7.8	+10.9

Seasonally Adjusted Index 227.7
Week Ago 231.4
Year Ago 215.7

Atomic Energy Commission requirements—1,150,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 5.8%.

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity }	Feb.	121.33	121.20	115.59	5.0
Peak—Class 1 Systems. } million kw	Feb.	98.8	103.8	94.2	4.9
Estimated Dec. '57 Peak }	Jan.	113.7	114.5	113.3	0.4
Production—billion kwhr	Feb.	48.67	55.50	47.99	1.4
Hydro		9.98	10.19	10.63	− 6.1
Fuel		38.69	45.31	37.36	3.6
Sales—billion kwhr	Jan.	49.15	47.46	46.32	6.1
Residential		14.44	13.22	13.45	7.4
Commercial		7.54	7.34	7.00	7.7
Industrial		24.68	24.44	23.60	4.6
Other		2.49	2.47	2.27	9.7
Fuel Consumption	Feb.				
Coal—million tons		13.21	15.98	13.44	− 1.7
Oil—million barrels		6.96	9.90	7.10	− 2.0
Gas—million cu ft		83.24	74.77	67.81	22.8
Net Income Class A & B Co's—million	Jan.	123.86	132.82	126.58	2.1
Residential Customers—millions	12 mos.	45.81	45.71	44.50	2.9
Revenue per kwhr	ended	2.59¢	2.60¢	2.64¢	− 1.9
Avg kwhr per customer	Jan. 31	2,985	2,969	2,778	7.5
Avg annual bill		$77.31	$77.19	$73.34	5.4

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Mar.	148	147	143	3.5
ENR Construction Cost	April	148.7	148.6	143.2	3.8
BLS Cost-of-living	Mar.	118.9	118.7	114.7	3.7
New Orders for Machinery (1950 = 100)	Feb.	158	152	161	− 1.9
NEMA Sales					
Insulation materials	Feb.	146	154	163	−10.4
Electric appliances		94	96	109	−13.8
Wholesale prices	Feb.				
Motors and generators		140.2	140.2	126.6	10.7
Transformers and regulators		146.6	146.6	131.2	11.7
Switchgear and fuses		164.4	164.4	147.5	11.5
GNP—annual rate—$ billion	4th Qtr.	423.8	413.8	397.3	6.7

MANAGEMENT BULLETIN

FINANCE

Electric utilities had no new security offerings last week. This is the first time it has happened since the start of the year. However two issues are expected this week. First will be the 300,000 common share offering of Portland General Electric Co and the other a $25 million debenture issue of the British Columbia Power Commission.

Electric utility offerings are heavy in the second quarter. More than $620 million has been scheduled of which $495 million will be in debt, $106 million in common and one in preferred stock, Irving Trust Co has reported. This will mean that about $1.4 billion of new securities will be sold in the first six months of 1957, representing 60% of the year's expected financing.

Security offerings are well spaced at the moment. So reports Irving Trust Co in releasing its "Financing Calendar" for April 15. No serious conflicts have yet developed. May and June are well filled, particularly in the third week in May and the first week in June, the bank has pointed out.

Rights offering is "quite satisfactory." So reported officials of Black Hills Power & Light Co in the offering of 34,377 common shares at $22 a share. Stockholders subscribed to 29,240 shares under their pre-emptive rights. Another 14,781 shares were subscribed to under additional rights. This made a total of 44,021 shares which was equal to 128.1% of the shares offered for sale . . . Colorado Central Power Co reports that 68,772 shares, or 93%, of its offering of 74,175 common shares were taken by stockholders at $22.50 a share. Balance of 5,403 was sold by an underwriting group headed by the First Boston Corp.

RATES

A $165,000 a year rate increase won by Public Service Co of New Hampshire. Authorization was received from the public service commission after company's request to withdraw its petition for a $600,000 a year advance in rates was granted by the PSC. Action resulted from a change in the commission rules relating to the accounting treatment of the effects of accelerated depreciation.

Rate specialist wanted. Cushing, Okla., Electric Light Dept is planning to retain the services of a rate specialist preparatory to launching study of a plan to reduce electric rates.

LEGISLATION

A state power commission authorized to build dams, operate hydro plants, and sell and distribute electricity would be established by a bill now before the Oregon legislature. Commission would be authorized to issue general obligation bonds up to 6% of assessed valuation of the state.

An appropriations bill amendment designed to encourage industry to locate in the state by enabling power companies to sell electricity more cheaply to industrial customers has been agreed to by the South Carolina Senate.

EMPLOYEE RELATIONS

Recent wage settlements. Utah Power & Light Co and IBEW agree to a 5% wage increase and a change in the wage progression schedules for non-exempt employees from a five-year progression to a four-year progression by the elimination of the first year, or first "step." . . . Virginia Electric & Power Co and IBEW sign two-year contract providing a 5% wage increase and a re-opening clause at the end of one year on rates of pay only.

"Monopoly Power as Exercised by Labor Unions" is the title of a new booklet just released by the National Association of Manufacturers. Leo Wolman, Columbia University and chairman of the study group which put the booklet out, said: "Unions now occupy a dominant position in the economic life of

the U. S. and are reaching out for political dominance as well. It is the duty, therefore, of every citizen to review—without malice, without prejudice, but with an objective eye—the present status of organized labor and the power exercised by union leadership and to reflect where this growing accumulation of power will take us if it continues on its present course." For copy, write NAM, 2 East 48th St., New York 17; cost 25¢ a copy.

ACQUISITIONS

Interstate Power Co is seeking Federal Power Commission approval to buy the Kansas City Power & Light Co's Peoples Gas & Electric Division (18,624 electric and 13,294 gas customers) for a base price of $16,150,515. Interstate Power also asks authorization to issue $20 million bonds and to issue sufficient number of new shares to net around $9 million. Proceeds will be used to retire bank loans; to pay for KCP&L's properties; to redeem outstanding bonds of Northwestern Illinois G&E previously acquired by Interstate, and to finance Interstate's construction program for the rest of 1957.

Utica, Miss., citizens vote 170 to 33 to grant Mississippi Power & Light Co a franchise. However another election is in the offing. Citizens will be asked to vote on a referendum whether it will or will not sell its distribution system to the company.

CONSTRUCTION

Latest releases on construction coming to our desk. Duquesne Light Co will install 172 Mw unit in its Elrama plant, bringing the station up to almost 500 Mw . . . Plant McManus (40 Mw) of Georgia Power Co was dedicated on April 26 . . . First unit of 100 Mw at Agua Fria plant of Salt River Power District has been put into commercial operation . . . Utah Power & Light Co will spend $2.5 million for building and real estate acquisition program to house its general administrative and sales staff in Salt Lake City . . . Toledo Edison Co plans to spend $19 million for new construction this year . . . Dayton Power & Light Co buys 1,000-acre tract in Adams County, along the Ohio River, as the site of its third generating plant, estimated to eventually have one million kw.

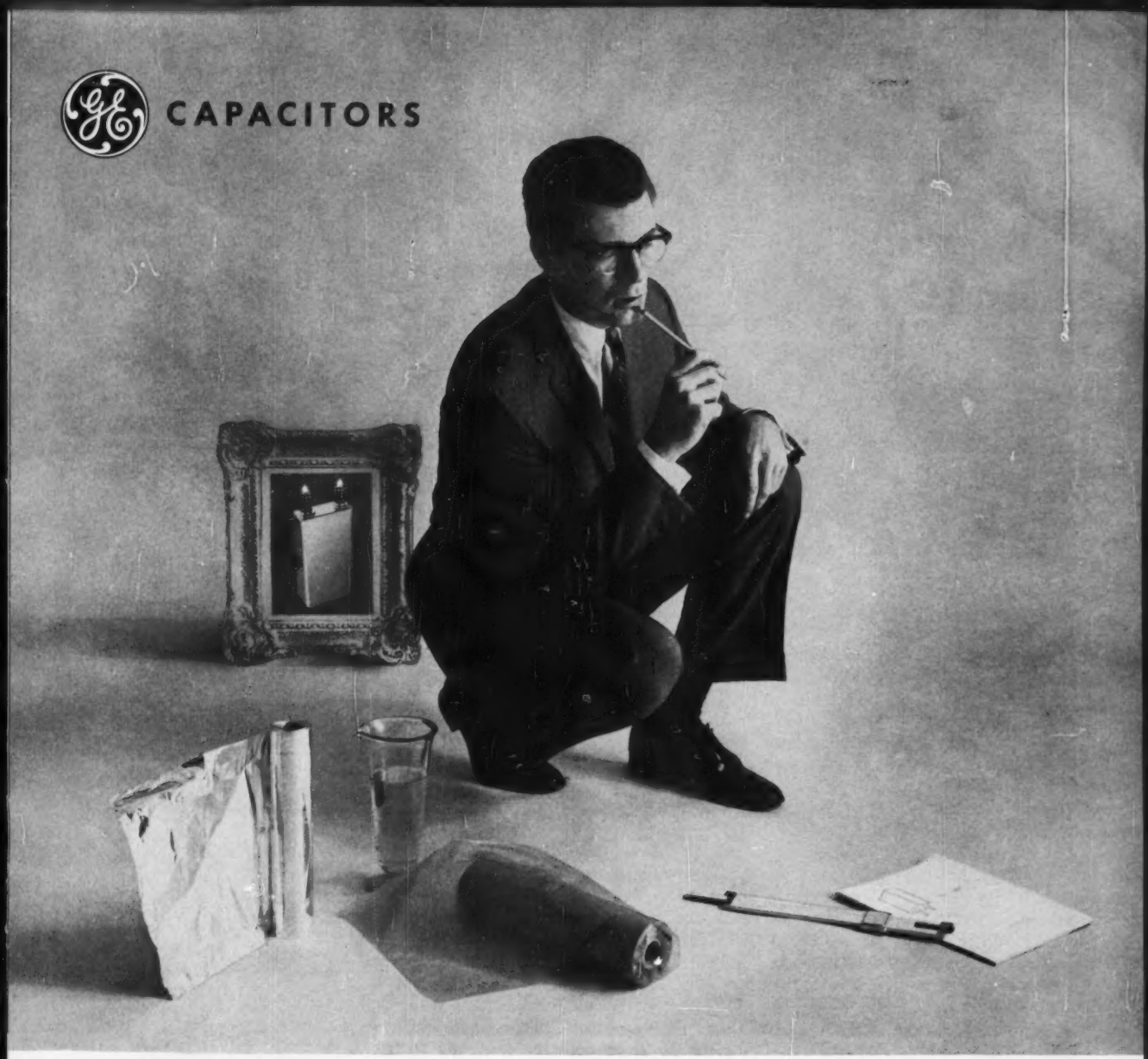
LITIGATION

Boston Edison Co wins court suit. Company receives favorable decision in the Suffolk Superior Court of Massachusetts under which Judge Daniel O'Connell dismisses a suit against company's policy of eliminating married women employees from its payroll.

NEW BOOKLETS

"I Want to Know About the Electric Industry" booklet has just been published by the Edison Electric Institute. A new question on atomic energy has been added, bringing to 29 the number of questions which are answered. Single copy costs 25¢ with quantity prices on application to the EEI, 420 Lexington Ave, New York 17, N. Y.

"Power Facts Handbook" being published by National Rural Electric Cooperative Association contains some interestingly presented statistical data on many phases of the electrical industry. Charts and tables tell the story of farm electrification, farm power use, federal financing of the rural electrification program. One chart of particular note compares Rural Electrification Administration interest rates to borrowers with the average and lowest interest rates paid by the federal government on marketable securities for the years 1935-'56. This is NRECA's answer to demands for higher interest rates on REA loans. Another section of interest to electric companies is a four-page table listing all certificates of accelerated amortization granted utilities. This chart also presumes to calculate the amount of the "subsidy" which the authors say is gained from use of the fast tax write-off. The way they figure it, it adds up to $4.7 billion over a 33⅓-year period. For copy write NRECA, Washington, D. C.; price $5.



TOMORROW:

50-kvar, 50-pound capacitors?

Metal foil, kraft paper, and a liquid dielectric... basically, that's all there is to a power capacitor. But add imagination and the facilities of General Electric research and anything can happen.

Progress in the manufacture and application of paper, foil, and liquid impregnant has already made capacitors smaller, lighter, and more dependable. General Electric designers work constantly with suppliers to make these materials more nearly perfect capacitor components.

General Electric capacitor development never stops. While the ideal of a one-pound-per-kilovar capacitor may seem just a pipe-dream today, the reality may be taken for granted tomorrow. This is just one project that G-E designers are seriously tackling today.

Want more information on General Electric capacitors? Your local G-E Apparatus Sales Engineer will be glad to help you. Or write to General Electric, Section 445-6, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

WATSON F. TAIT, JR | EDWIN H. SNYDER | ARTHUR R. NELSON | EDWARD R. EBERLE

Public Service E&G Elevates Four Executives

Watson F. Tait, Jr, has been elected executive vice president of Public Service Electric & Gas Co. Replacing him as vice president in charge of electric operation is Edwin H. Snyder. Also advanced were Arthur R. Nelson, to general manager of the electric department, and Edward R. Eberle, to general manager-services.

Tait, vice president of electric operation since 1950, has held various positions in the electric department since he joined PSE&G in 1922. In 1938 he was named assistant general superintendent of electric distribution and advanced to assistant general manager of the electric department in 1942. He became general manager in 1948. At present he is a director of both PSE&G and Atomic Power Development Associates, Inc. Tait, now president of New Jersey Utilities Association, is a graduate of Lehigh University.

Snyder, who comes to his new position from that of electric department general manager, has been with PSE&G since graduating from Lehigh in 1923. He rose from cadet engineer through posts of increasing responsibility and was named assistant chief engineer of the electric engineering department in 1943.

Nelson, who assumes Snyder's former post, has been general superintendent of electric distribution since 1949. A 1920 graduate of Harvard University, Nelson joined PSE&G the same year and advanced from cadet engineer to assistant division superintendent of electric distribution in 1930. He became superintendent of the Essex Division electric distribution department in 1940.

Eberle, a 24-year PSE&G veteran, is former manager of industrial relations, commercial operations. He previously served as managerial assistant in the general commercial manager's office. Eberle graduated from Yale University in 1931 and from Harvard Graduate School of Business Administration.

Pearson and Tolk Elected VP's

Southwestern Public Service Co has announced the elections of W. L. Pearson and Roy Tolk as vice presidents of the Amarillo, Tex., utility.

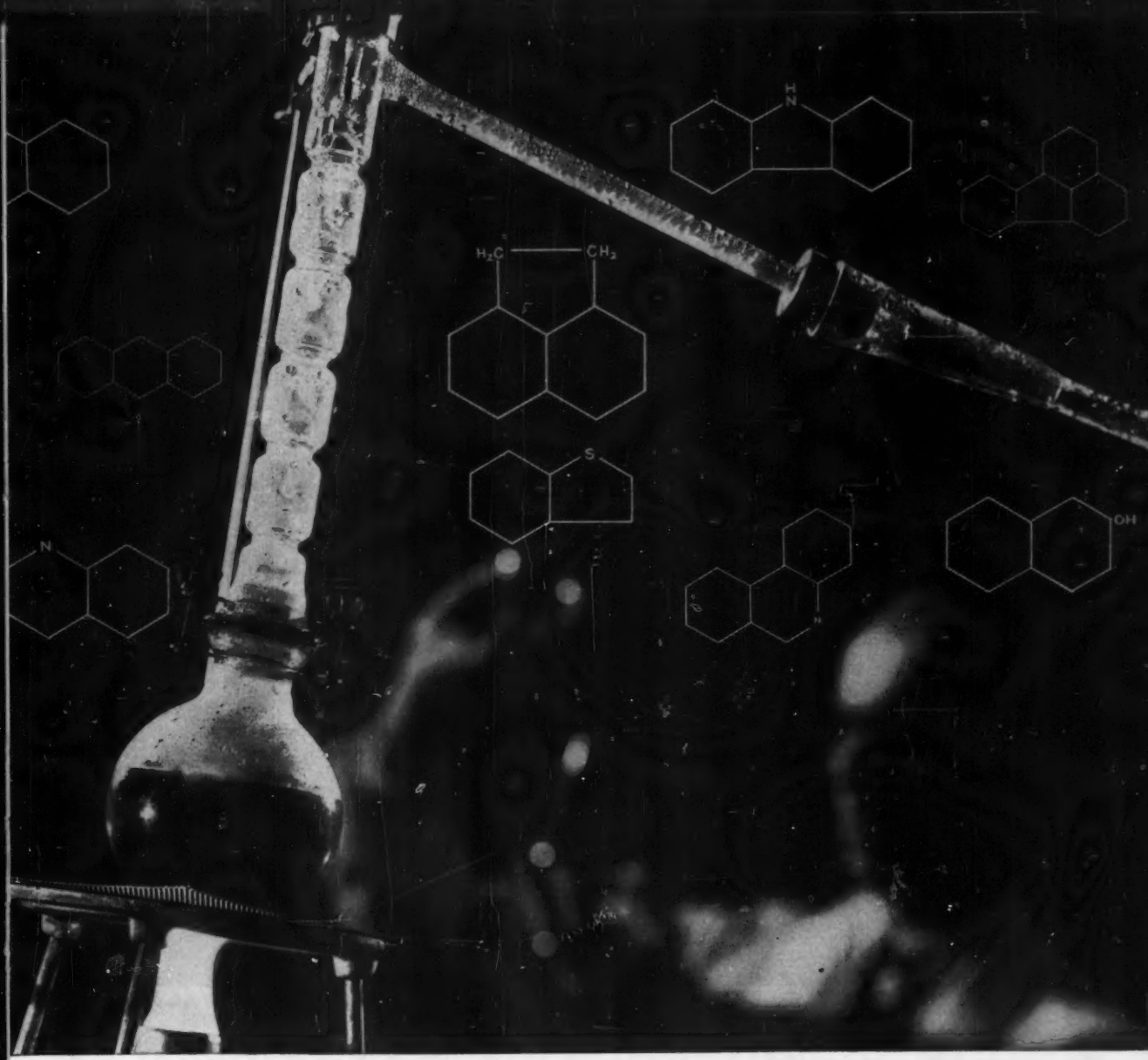
Pearson, who has been industrial manager since 1952, began full-time employment at Southwestern PS upon graduating from the Texas Technological College in 1931. During his 26 years with the company he has also been local manager at Slaton and Canyon, power sales engineer at Plainview and Lubbock, and division utilization manager at Lubbock.

A past president of the Petroleum Electric Power Association, Pearson is now serving as general chairman for the organization's annual meeting which will be held in Amarillo in June.

Tolk has been serving as assistant to the executive vice president and general manager since 1953. Since joining Southwestern PS in 1938, he has held a variety of positions, including statistical engineer, engineer, and draftsman. An electrical engineering graduate of the University of Texas, Tolk is a member of Eta Kappa Nu, honorary engineering fraternity. He is also a graduate of the Public Utility Executive Program of the University of Michigan.

W. L. PEARSON

ROY TOLK



CREOSOTE

. . . the modern preservative with a proved record

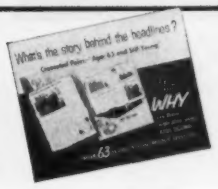
Behind each gallon of Creosote . . .

A corps of chemists and engineers, engaged in field testing, research, analysis and production control, is your assurance of continued, unequalled performance from creosote: the only wood preservative that can prove *both* cleanliness and 50-year life.

The five-ball distillation tower shown for example, is being evaluated by Koppers researchers for more closely controlled distillation of creosote into its various components. The chemical multiplicity of creosote—over 50 of its 162 ingredients have been proved toxic to insects and fungi—is one key to its superior effectiveness as a wood preservative.

Documented case histories of 50, 60 and even 80-year life from pressure-creosoted poles have convinced utilities of the unequalled "staying power" of creosote.

Much time is being devoted by Koppers to research into creosote's properties and participation with industry groups in improvement of preservative standards. As a result, you get clean *proved* protection for poles and crossarms from creosote, the 50-year plus preservative.



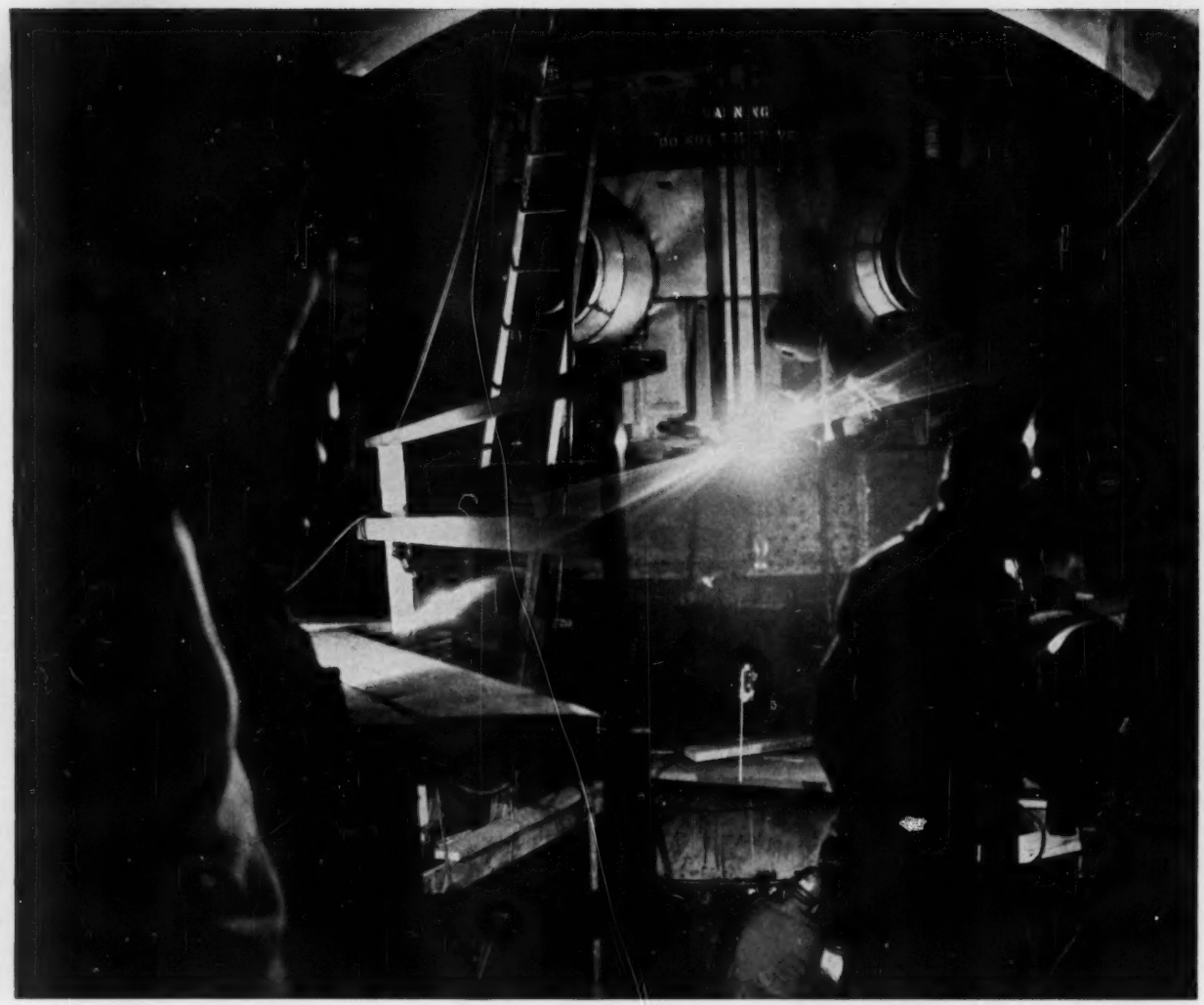
A new booklet giving interesting facts about preservative performance is now available to utility executives. Write for your copy.

KOPPERS

CREOSOTE

TAR PRODUCTS DIVISION

Pittsburgh 19, Pa.



Photos by Robert Yarnall Richie

Rome's station control cable installed

Artist's Sketch of first U. S. full-scale atomic-electric plant. This revolutionary power plant—under the operation of Duquesne Light Company of Pittsburgh—will be delivering electricity to home and industry in the Pittsburgh area late this year or early next.

Atomic-Electric Power will be controlled from this large cabinet installation at the Shippingport atomic power station. Nearly ten miles of Rome's highest quality station control cable were used in this vital system.

Partner to the Atom. Rome's control cable is here being installed in the nation's first major atomic power plant at Shippingport, Pennsylvania. Rome Cable furnished over 50,000 feet of station control cable for this important installation.

in Shippingport atomic power station

This country's first full-scale atomic power plant for the generation of electricity will contain almost ten miles of Rome's highest quality station control cable.

The selection of Rome's Rozone-Roprene cable—with a special over-all asbestos outer braid—for this epoch-making installation was no accident, for individual Rozone insulated-Roprene jacketed conductors represent the ultimate in control cable design and performance.

Advantages of Rozone insulation. Rozone—a high-quality oil-base compound—is an excellent insulation. Long and widespread experience has proved that its high-dielectric and impulse strength, combined with its resistance to corona and ozone cutting, makes it an ideal insulation for control and high-voltage power cables. Its electrical properties are practically unaffected by long-time immersion in water or burial in the ground.

Advantages of Roprene jacket. Roprene—a neoprene synthetic rubber compound developed by Rome Cable—provides an extremely durable and permanent mechanical protective covering for the individually Rozone-insulated conductors. It assures terminations that are resistant to abrasion, weather, and attack by chemicals and oils. And it is exceptionally resistant to fire.

Additional fire protection for this particular cable included a special over-all asbestos outer braid.

Specify premium-quality Rozone-Roprene control cable for your next job. Contact your nearest Rome Cable representative for more information—or write to Department 802, Rome Cable Corporation, Rome, New York.

ROME CABLE

CORPORATION

Anderson Names Bitzer Sales Vice President

Newly elected vice president in charge of sales for Anderson Electric Corp is C. B. Bitzer, who has served as general sales manager of the Birmingham, Ala., company since September, 1955.

Bitzer has been associated with Anderson Electric, formerly Anderson Brass Works, Inc, since 1953, when he joined the firm in the capacity of Distributor Division Sales Manager. He was later named assistant to the general sales manager and general sales manager.

Before accepting this appointment, he was with Westinghouse Electric International Co. During his 13 years with Westinghouse he served in various positions, including manager of the appliance department and division manager for Consumer Product Sales.

General Cable Organization Advances Two

GEORGE A. KNOWLES WILLIAM A. POWELL

George A. Knowles has been appointed assistant vice president and general sales manager of General Cable Corp. He succeeds William A. Powell, who has advanced to the position of president of Clifton Conduit Corp, a subsidiary.

Knowles, in his new post, transfers to New York headquarters from Boston, where he previously served as assistant vice president and district manager of the New England district.

Powell, who will make his new headquarters at Clifton's Baltimore plant, assumes the post left vacant by G. L. Hatheway, recently appointed chairman of the board.

PERSONAL BRIEFS

Duane A. Herman has been named manager of the Southern Electrical Division of Western Light & Telephone Co. He succeeds the late **William A. Fowler.**

New assistant to the superintendent of power at Utah Power & Light Co is **John S. Anderson.** Also promoted were **J. C. Conder** to steam production engineer; **Fred W. Kemper** to Carbon plant superintendent; and **J. H. Hutchinson** to Hale plant superintendent.

At Niagara Mohawk Power Corp's Western Division, **John E. Lemmler** was named Northern district manager; **Harry C. Gilbert,** Angola district manager; **Philip W. Evans,** first resident manager of Dunkirk district; **Walter J. Stepien, Jr,** residence sales supervisor of the division; and **Leon B. Kiersz,** East Buffalo area manager. **Osborn B. Nye** is new business manager of the Eastern Division.

At Westinghouse Electric Corp, **James C. Sheehan** has been named vice president of operations for the Credit Corp . . . In conjunction with the formation of two new headquarters advertising departments to replace the former industrial advertising component, **W. T. Rush** has been named manager and **C. A. Boyles,** assistant manager of general products advertising, and **R. F. Gomber** is manager and **T. J. Farrahy** assistant manager, apparatus-defense advertising department.

Recently named manager of Bakelite Co's Extrusion Materials Division was **M. M. Suba.**

Allis-Chalmers Manufacturing Co product departments have appointed **Milton J. Kloosterboer** as programmer, computer laboratory; **Lionel G. Moore, Jr,** engineer, processing machinery department; **Robert Thoreson,** application engineer, steam turbine department; **John J. Dwyer, Jr,** switchgear engineering department.

New manager of manufacturing at General Electric Co's specialty transformer department is **J. Richard Garvin.**

OBITUARY

Herbert W. Briggs, 75, public utilities financial executive and longtime director of Southwestern Public Service Co, died recently.

Can We Afford a $71.8 Billion Budget?

THE BUDGET submitted to Congress by President Eisenhower for the year beginning July 1 proposes federal spending of $71.8 billion. In only four years, three during World War II and one during the Korean War, has the government spent more. Under the proposed budget the government expects to collect $73.6 billion, mostly through individual and corporation income taxes.†

The principal reason for the size of the budget and for this year's increase is an expanding defense program. About 60% of all budget expenditures in the coming fiscal year will be for national security programs. Moreover, this area accounts for about 90% of the proposed increase in federal spending. In addition, as the chart shows, there are large expenditures proposed for purposes other than defense.

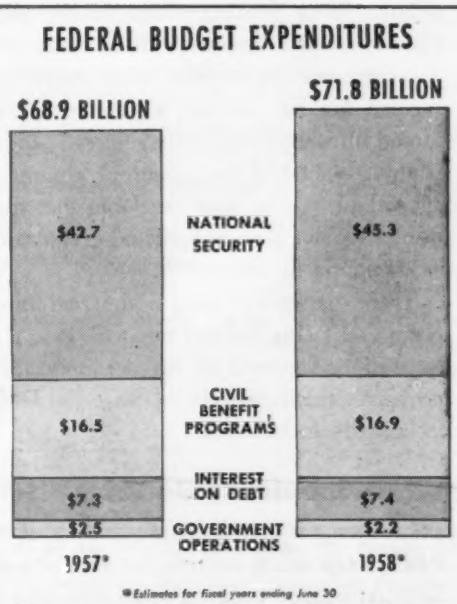
Continued budgets of this size, some contend, will lead to inflation and wreck our economy. It has been suggested that they might lead to "a depression that will curl your hair." Yet many insist that the budget, large as it is, still is inadequate in many respects — for defense, schools, agriculture, small business, health, research, indeed, for almost every activity in which the government has become involved.

Is It Really Too Big?

Actually, the proposed budget would place no greater burden on the economy than any budget in the last six years, because our economy has been growing. Federal spending per capita under the proposed budget will be about $416, or $10 more than this year; but our per capita income rose almost $80 last year. And, because of our increasing population, next year's expenditures will, in fact, amount to *less* per capita than in 1954 when federal spending was $4 billion lower.

Another way of measuring the burden of government expenditures on the economy is to compare the purchases of goods and services of all branches of government — federal, state and local — with the total output of the nation. The share of our national product taken by government this year will be about the same as in the past two years and, furthermore, about the same as the average for the past 28 years.

By the standard of any recent year, the budget is within the means of the American economy. In this sense, we can "afford" it. But the pros-



†*These figures refer to the regular federal budget and do not include operations of trust funds, primarily for social security programs and the new federal aid program for highways, which are financed by special taxes.*

pect of steadily increasing budgets, requiring 20% or more of our national income, introduces another threat.

The Real Threat

Large and rising budgets that do not balance government spending with higher tax collections clearly would be inflationary and would destroy the value of the savings and income of all who lagged in the race with climbing prices. But serious dangers will still exist even if our budget continues to be balanced, as this year's is.

- **Budgets that require a large take in taxes eat up the savings required to finance private industry.** What the taxpayers must give the government they cannot save. This deprives private industry of the savings and resources needed to expand and modernize producing facilities.
- **High tax rates also undermine the incentive to save and invest in normal business enterprises by taking such a large share of any income gained.** Taxes on corporation income now take 52% of all income over $25,000. And taxes on individual incomes can take as much as 90% of earnings that remain after this 52% bite.
- **High taxes encourage, on the part of both individuals and corporations, the search for "gimmicks" and special treatment.** As a leading character in Cameron Hawley's novel *Executive Suite* observed: "To a far greater degree than most people realize, income tax has become a primary governing factor in corporation management." Indeed, it is only because of the numerous gimmicks and special provisions now available that high tax rates have not already inflicted greater damage to economic incentives.

These dangers comprise the real threat of large and rising federal budgets. It is a threat to continued growth of our economy, and it is no less a threat merely because the budget is technically in balance.

What Should Be Done?

In attempting to hold government spending within reasonable bounds, we should *not* hold back on needed civilian programs. The heavy demands now being urged at all levels of government for roads and schools, for instance, are largely the result of failure to keep pace with the growth of the country. Furthermore, we cannot cut provisions for national security below the minimum level of safety. And unhappily, defense in the rocket and missile age is fantastically and ever increasingly expensive.

What we *can* do is enforce some financial discipline on our military leaders, and hold down our defense expenditures by making sure their demands are justified and by requiring efficiency. In the civilian programs, though some need to be increased to serve a growing economy, we can eliminate the outright waste.

A More Difficult Job

We must also do something far more difficult, and that is to reduce federal programs of aid to special groups at the expense of all the taxpayers. The new budget calls for over $5 billion for veterans, and another $5 billion for farmers. A number of industries and areas stand to receive aid in large amounts based less on necessity than on political pressure. These demands for increased aid, year after year, must be resisted if we are to have any hope of stopping a relentless rise in our budget.

Then, as our national income increases, we can look forward to reducing tax rates and providing greater incentives for the private sector of the economy. **Only in this way — by keeping government spending in line with economic growth — can we prevent our federal budget from being a crippling burden.**

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw
PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

MEETINGS CALENDAR

APRIL

Association of Iron & Steel Engineers—Annual Spring Conference, Netherland Hilton Hotel, Cincinnati, April 29-May 1.

Edison Electric Institute—Insurance Committee, Williamsburg Inn, Williamsburg, Va., April 29-30; Accident Prevention Committee, Algiers Hotel, Miami Beach, Fla., April 29-May 1.

MAY

American Institute of Electrical Engineers—Northeastern District Meeting, Wendell-Sherwood Hotel, Pittsfield, Mass., May 1-3; East Central and Middle Eastern District Meeting, Dayton-Biltmore Hotel, Dayton, Ohio, May 7; Protective-Relaying Conference, Hightower Auditorium, Georgia Institute of Technology, Atlanta, Ga., May 9-10.

• **Edison Electric Institute**—Transmission and Distribution Committee, Irem Temple County Club, Dallas, Pa., May 2-3; Prime Movers Committee, Tides Hotel, St. Petersburg, Fla., May 6-8; Commercial Cooking and Water Heating Committee, Sheraton Hotel, Chicago, Ill., May 7; Hydraulic Power Committee, Highland Hotel, Massena, New York, May 13-15; Industrial Relations Committee, EEI Headquarters, New York City, May 16; Electrical System and Equipment Committee, Statler Hotel, Buffalo, N. Y., May 20-21; Accounting Division Time and Place Committee, jointly with AGA, AGA Headquarters, New York City, May 23; Financing and Investor Relations Committee, Edgewater Beach Hotel, Chicago, Ill., May 31-June 1.

Pennsylvania Electric Association—Hydraulic Power Committee, Skytop Lodge, Skytop, Pa., May 2-3; Communications Committee, Hotel St. Francis, Canton, Ohio, May 6-7; Eighth Annual Customer Relations Conference, Hotel Hershey, Hershey, Pa., May 8; Electrical Equipment Committee, Hotel Roosevelt, Pittsburgh, Pa., May 9-10; Relay Committee, Bedford Springs Hotel, Bedford Springs, Pa., May 16-17; Systems Operation Committee, Skytop Lodge, Skytop, Pa., May 23-24.

Southeastern Electric Exchange—Engineering & Operations Sections, Fontainbleau Hotel, Miami Beach, May 2-3; Heat Pump Steering Committee, sponsored jointly with Association of Edison Illuminating Companies and Edison Electric Institute, Battle House, Mobile, Ala., May 10-11.

• **American Society for Testing Materials**—New England District Meeting, University of Rhode Island, Kingston, R. I., May 3.

Air Conditioning and Refrigeration Institute—Annual Meeting, The Homestead, Hot Springs, Va., May 5-8.

Northwest Electric Light & Power Association—Business Development Section, Vancouver, B. C., May 6-8.

Appliance Parts Jobbers Association, Inc—18th Annual Meeting, Balmoral Hotel, Miami Beach, Fla., May 7-11.

Electric Companies Advertising Program—Copy Group Meeting, Hotel Statler, Cleveland, Ohio, May 8.

Public Utilities Advertising Association—Annual Convention, Hotel Statler, Cleveland, Ohio, May 8-10.

Industrial Nuclear Technology Conference—Museum of Science and Industry, Chicago, Ill., May 14-16.

Pacific Coast Electrical Association—Annual Convention, Fairmont Hotel, San Francisco, Calif., May 15-17.

New York State Society of Professional Engineers—1957 Engineering Industries Exposition in connection with its annual convention, Statler Hotel, New York City, May 16-18.

American Institute of Mining, Metallurgical and Petroleum Engineers—Eleventh Annual New England Regional Conference, Hotel Statler, Boston, Mass., May 17-18.

• **American Public Power Association**—Lake Placid Club, Lake Placid, N. Y., May 21-23.

National Association of Electrical Distributors—49th Annual Convention, Sheraton Park and Shoreham Hotels, Washington, D. C., May 26-29.

JUNE

Electric Companies Advertising Program—Management Group, Palmer House, Chicago, Ill., June 2.

• **Electric Companies Public Information Program**—Steering Committee, Palmer House, Chicago, Ill., June 2.

• **Eighth Annual Conference on Industrial Research**—Sponsored by the Department of Industrial and Management Engineering of Columbia University, Arden House, Harriman, N. Y., June 2-7.

American Society of Refrigerating Engineers—53rd Annual Meeting, Hotel Fontainbleau, Miami Beach, Fla., June 3-5.

Edison Electric Institute—Annual Convention, Palmer House, Chicago, Ill., June 3-5.

• **National District Heating Association**—48th Annual Meeting, The Homestead, Hot Springs, Va., June 3-6.

• **Electric Association**—Chicago Electrical Industry Show, Conrad Hilton Hotel, June 4-6.

American Institute of Electrical Engineers—Industrial Power Rectifiers and Semiconductors-Metallic Rectifiers Committees, Morrison Hotel, Chicago, Ill., June 4-5; Summer General Meeting, Sheraton Mount Royal Hotel, Montreal, June 24-28.

American Society of Mechanical Engineers—Semi-annual Meeting, Sheraton-Palace Hotel, San Francisco, Calif., June 9-13.

Public Utilities Association of the Virginias—Accident Prevention Conference, Daniel Boone Hotel, Charleston, W. Va., June 14.

American Society for Testing Materials—Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 16-21.

• **Industrial Management Center**—Fourth Annual Material Handling Training Conference, Lake Placid, N. Y., June 16-29.

• **American Society for Engineering Education**—Annual Meeting, Cornell University, Ithaca, N. Y., June 17-21.

• **Canadian Electrical Association**—Annual Convention, Manoir Richelieu, Murray Bay, Quebec, June 19-21.

Wisconsin Utilities Association—Annual Convention, Accounting Section, King's Gateway Hotel, Land o' Lakes, Wisconsin, June 23-25.

Michigan Electric Association—Grand Hotel, Mackinac Island, Mich., June 23-26.

American Society of Heating and Air Conditioning Engineers—Semi-annual Meeting, Manoir Richelieu, Murray Bay, Quebec, June 24-26.

• Additions this week.

R/W Meeting Slated for Electric Companies

The first national gathering of electric company right-of-way men is scheduled for May 15 at Chicago, Ill. Problems and practices in acquiring sites and rights of way will be discussed at the one-day session. The meeting will be held in the Conrad Hilton Hotel. For details write R/W Editor, Electrical World, 330 West 42nd St., New York 36, N. Y.

New line of Alcoa heavy-duty, eliminates all loose parts

Three new extruded, parallel groove clamps handle #2 to 400MCM conductor—

Economically priced

Are your men always dropping or losing the nuts and washers from old-fashioned clamps? End fumbling loose parts. Here's the answer: Alcoa's new heavy-duty universal clamps—all loose parts have been eliminated. They can be applied without being taken apart.

These new clamps also reduce inventories. A newly developed universal groove design allows just three clamps to cover the full ACSR range from # 2 to 397.5MCM (18/1), stranded from # 2 to 400MCM. They're competitively priced heavy-duty clamps.

Top and bottom parts of the clamps are Alcoa® Aluminum Extrusions—made strong, solid, dense, with a heat-treated alloy. Being wrought metal, tapped bolt holes have strong threads. Bolts are anodized to reduce thread friction. All parts are aluminum to equalize expansion, eliminate corrosion. Grooves are specially treated and coated with No-Ox-Id. Experience gained during a quarter century of making parallel groove clamps has been applied in designing these new heavy-duty universal clamps.

Months of extensive laboratory testing have proven these heavy-duty clamps. They have undergone 1,000 heat cycles using various conductor combinations; test current produced conductor temperatures of 200° F—without significant change in connection resistance.

Your Alcoa representative has samples of these clamps and full details. Let him show you how they can reduce your inventory, help on your connecting problems, make your men's work easier. Or write ALUMINUM COMPANY OF AMERICA, 2306-D Alcoa Building, Pittsburgh 19, Pa.

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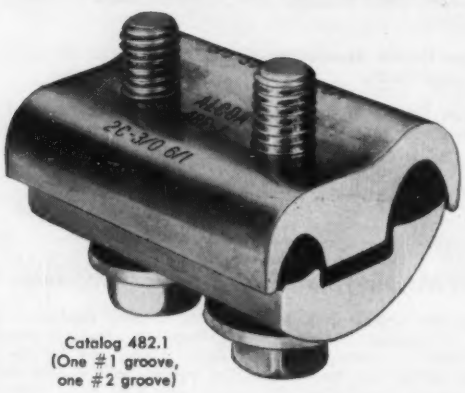
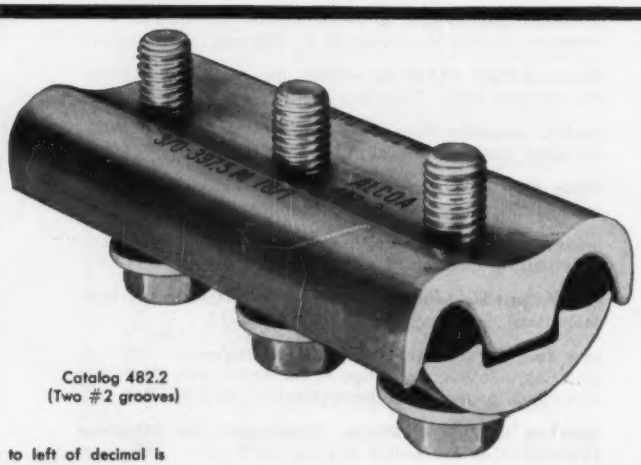


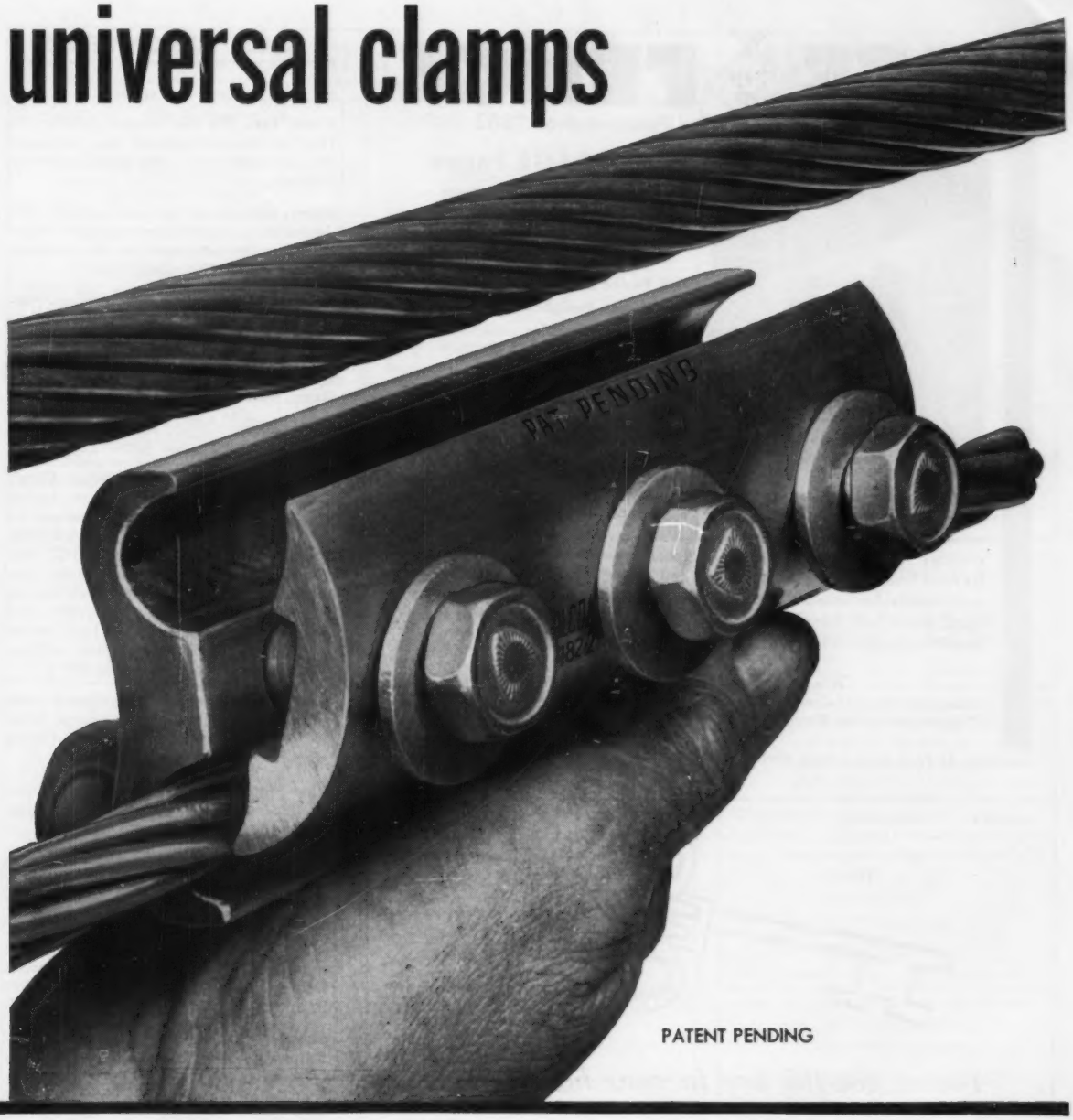
Catalog 482.1
(One #1 groove, one #2 groove)



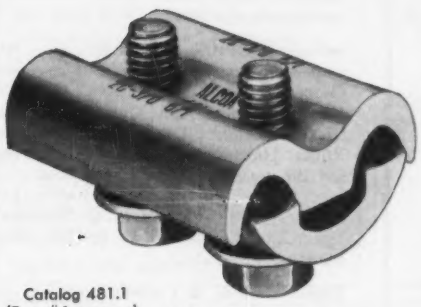
Catalog 482.2
(Two #2 grooves)

Functional catalog numbers: digit to left of decimal is number of one groove; digit to right is other groove.

universal clamps



PATENT PENDING



Catalog 481.1
(Two #1 grooves)

RANGE OF CONDUCTOR FOR EACH GROOVE SIZE

Groove Size	Dia. Min.	Dia. Range Max.	ACSR Min.	ACSR Max.	Stranded Conductor Min.	Stranded Conductor Max
1	.292	.502	2 (6/1)	3/0 (6/1)	2	3/0
2	.464	.743	3/0 (6/1)	397.5MCM (18/1)	3/0	400MCM

(See captions under clamps)

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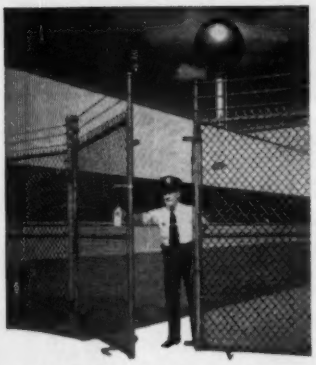

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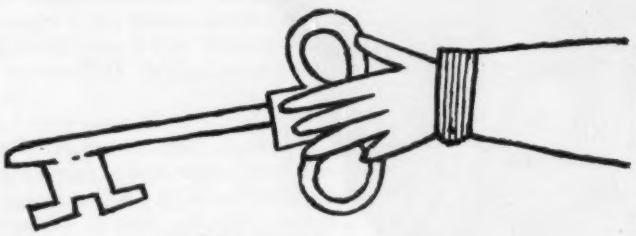

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SALES ASSIGNMENTS

COMPANY STAFFS

Clark Bros Co has named Arthur N. Haar as western regional sales manager for industrial sales, with headquarters in Chicago.

Essex Wire Corp has advanced O. W. Andersen to succeed retiring J. J. Madden as sales manager of the Paranite Wire & Cable Division.

General Electric Co's metallurgical products department has designated R. J. Jablonski as sales representative for Carboloy cemented carbide cutting tools in the Flint, Mich., area. He succeeds Paul Kunz, transferred to Houston, Tex.

H. M. Harper Co has appointed Roderick Martin, Jr, as Florida district manager.

International Business Machines Corp's Data Processing Division has named Harry L. Maurer district manager of customer engineering in the Manhattan, Bronx, and Brooklyn, New York, area . . . Gilbert A. Shedd is new senior representative in the eastern sales region. He will coordinate sales activities and planning of applications of IBM equipment for customers in the public utilities, petroleum, and publishing fields.

I-T-E Circuit Breaker Co's Transformer and Rectifier Division has named Elton W. Turner as manager of Electro Clutch sales.

Line Material Co has appointed Stanley D. Reed as field engineer in the Chicago area with offices at Melrose Park.

Minnesota Mining & Manufacturing Co has promoted William H. Madden to distributor trades sales manager, Magnetic Products Division.

S & C Electric Co's new sales engineers for the Northern California and Nevada territory are William R. Sibbett and Frank C. Trayer.

Simplex Wire & Cable Co has made the following appointments: E. F. Galvin as New England district manager to succeed retiring Arthur W. Coombs; Clarence Beard, assistant New England district manager; E. A. Carlson, manager of railroad sales; and Paul J. McHale assumes railroad sales duties previously handled by Carlson in New England.

Sylvania Electric Products, Inc, has named H. Page Woodbury as sales supervisor for lighting products in the New York section of the Metropolitan district . . . Lighting Division has appointed Robert Houston lighting sales supervisor for the northern New Jersey area . . . Lou Ridgeway, field representative, Los Angeles district, transfers to Sylvania's International Division as resident sales manager for Cuba.

Union Carbide & Carbon Corp has appointed Charles Lowe as technical representative for the Extrusion Materials Division of Bakelite Co in the Hartford, Conn., territory.

PROFESSIONAL SERVICES

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Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

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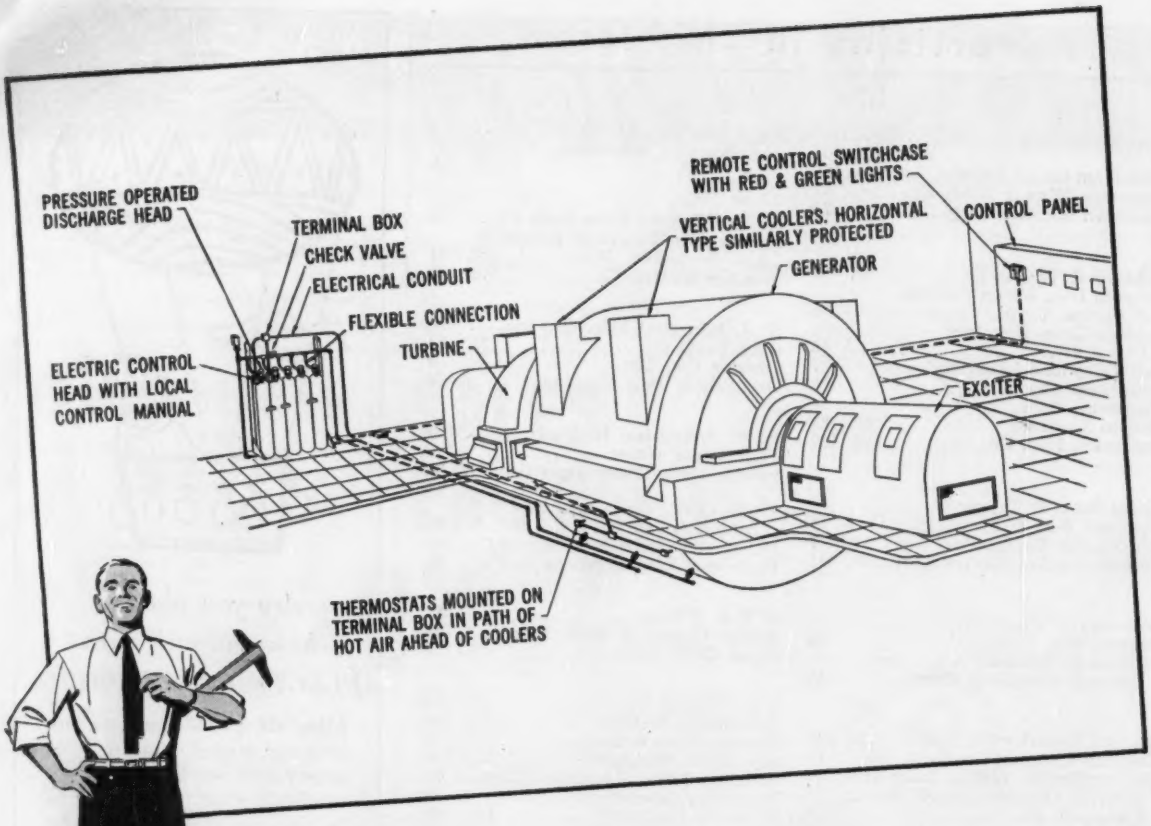

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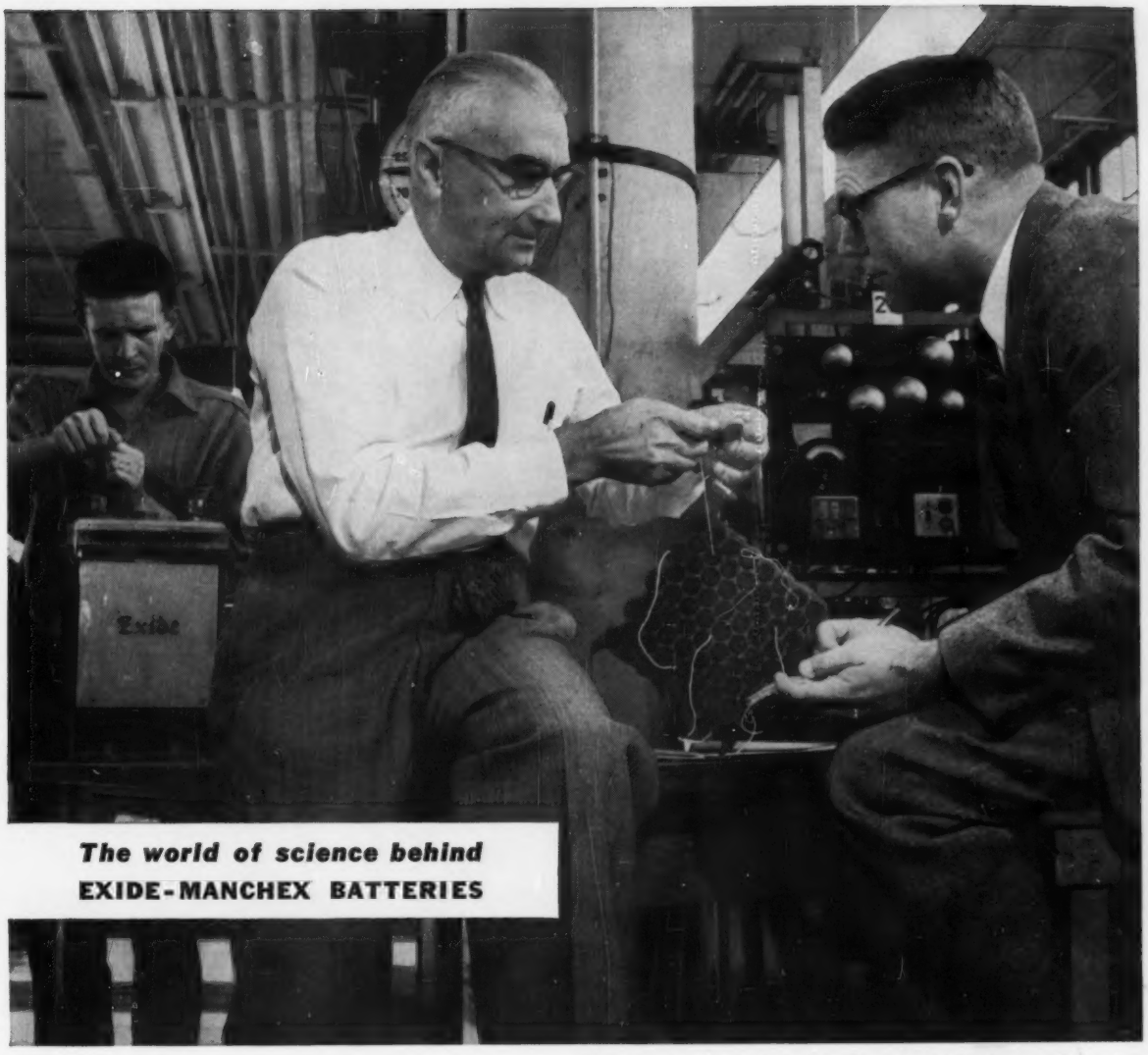

The world of science behind
EXIDE-MANCHEX BATTERIES

Being interviewed is R. R. Jardine, Supervisor of Development Engineering

"Open windows let electrolyte in—power out"

At the Exide Laboratories—**Reporter:** You mean there's an important connection between the electrolyte and the battery power?

Jardine: Yes indeed. You see how I'm running these strings through the "windows" in the Exide-Manchex positive plate? These openings give the electrolyte free access deep into the interior of the plate.

Reporter: How does that affect battery performance?

Jardine: It means there's no time lag—no slow filtering of the electrolyte to reach the active material. There's a continuous contact between the electrolyte and the entire plate. So the power is there when it's called for.

Reporter: Do other batteries have this free access of electrolyte to the active material?

Jardine: No they don't. Because only the Exide-Manchex has the positive plate with the spiral lead buttons locked into a cast alloy grid.

Reporter: Obviously this is an important feature of the Exide-Manchex Battery.

Jardine: Yes it is, but it's just one of many engineering details that contribute to their long life and high capacity.

Note to battery users: When you order batteries for float or cycle service in stationary applications, be sure to specify Exide-Manchex. Write for detailed bulletin. Exide Industrial Division, The Electric Storage Battery Co., Philadelphia 2, Pa.

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Regulators save $7,504

LTC on transformer with ±10% regulation - - - -	$19,174
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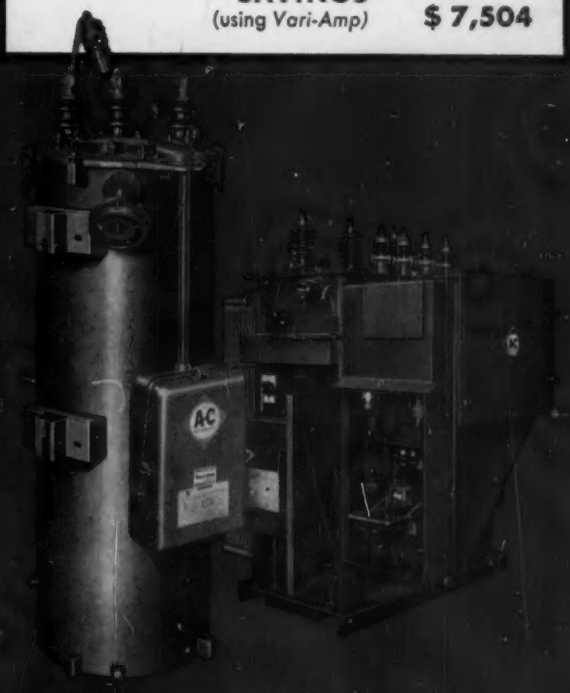
SAVINGS (using *Vari-Amp*)	$ 7,504



Here are the four steps needed to make this comparison:

1. **Select substation size.**
2. **Determine percent regulation required.**
3. **Select proper size regulating unit, based either on current or kva, and range of regulation required.**
4. **Compare cost of LTC portion of transformer and 3 distribution regulators.**

In this example, the substation size is 7500 kva, 328 amperes, 13,200 volts, self-cooled. Regulation required is +10% −5%.

Key to savings is *unequal* range of regulation using *Vari-Amp*

Regulation needs are figured either on basis of setting permanent taps of transformer up 5%; or using an alternate voltage on low voltage winding to provide a 5% boost.

Then only a 5% raise from the regulator is needed. On maximum load the transformer raises voltage 5%; regulator raises voltage 5% . . . a net raise of 10%.

This requires regulators to carry 7500 through kva or 328 amperes at the 5% *Vari-Amp* position.

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The selection: regulators rated 167 kva, 7620 volts, 219 amperes.

Comparing costs shows a saving of $7504 using Allis-Chalmers distribution regulators with *Vari-Amp*.

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- 5/8% step regulators
- Unit construction
- *Vari-Amp*

A-5297

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